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OCEANOGRAPHY AND ITS NECESSITY FOR FISHERIES PROGRAMME IN THE INDO-PACIFIC REGION

by
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Oceanography comprises all branches of the marine sciences, the physics, chemistry and biology of the sea, as well as submarine geology. The different branches have found application to various problems of economic nature, and among these the application to fisheries problems takes a prominent place.

When applied to fisheries, the biological aspects enter into the foreground. For the rational utilization of stocks of fish or shell-fish and for the purpose of indicating in advance the year to year fluctuations in the commercial stock, it is necessary to study the spawning, food, and schooling habits of the various species, and also their possible wanderings and their natural enemies.

Knowledge of the physical-chemical environment of the species enters into the picture because the behaviour of several species may depend upon the character of the currents or upon temperature or salinity conditions; and the available food depends upon the primary productivity of the sea, which again is related to the concentration of the 'plant nutrients', phosphates, nitrates and so on. The concentrations of these compounds may again depend upon currents, vertical mixing or other physical processes, for which reason we have to deal with a very complex series of events.

It is not my intention to attempt a review of the present status of oceanography or of the parts of the marine sciences which are of particular importance to fisheries problems, but I would like to present some ideas as to how oceanographic research with application to fisheries in mind may be started in regions where the knowledge of the oceanographic conditions is more or less lacking or is very superficial.

It may then be borne in mind that in northwestern Europe the marine sciences have been developed long before any application to fisheries was considered. The International Council for the Exploration of the Sea (ICES) was established 55 years ago, partly to promote an integrated study of the physical-chemical-biological problems and partly to apply the knowledge, that might be gained, to fisheries problems. In the years since 1902 basic oceanography and the study of the problems of the fisheries have advanced side by side. Fisheries research has progressed rapidly, and both the basic and the applied science has gained by the contact and the mutual stimulation that has been possible in the ICES.

In the Indo-Pacific region where important fisheries take place, but where oceanographic information is scant, the development of basic and applied oceanography must also be advanced in parallel.

The situation in the Indo-Pacific region is that the deep sea areas have to some extent been explored by large expeditions from western European countries, but the nations of the region

have not participated in these explorations, and they have only a limited number of persons with training in oceanography.

On the large expeditions, the efforts were directed towards the study of oceanic conditions, but the coastal areas where the important fisheries take place, have hardly been touched. From these regions, only surface conditions, currents, temperature and salinity are known from observations by merchant ships, and limited knowledge as to the biology of the waters has been accumulated, partly from the commercial catches of fish and partly from studies of the littoral fauna and the fauna and flora of the beach-waters.

From the point of view of the fisheries, the first step towards promoting oceanographic studies should, in my opinion, be the systematic examination of the coastal waters. This can best be done by the establishment of marine biological stations, which besides tackling the numerous biological problems, taxonomic, ecological and others, would have to take up studies of the physical-chemical environment. Such stations would also have to undertake the training of scientific and technical personnel needed both in fisheries research and for the further development of basic oceanography. It may, of course, be necessary to keep in contact with the development of oceanography in other countries, but it is essential that the basic training takes place in the general region in which the scientists later on are to work. In the case of the technical personnel, the training under tropical conditions is all-important.

Fisheries research must be undertaken simultaneously with the establishment and gradual expansion of the work at the marine biological stations, but this work must be concentrated on problems of more direct economic importance, such as the study of spawning grounds, spawning habits, concentration of certain species and so on. For the interpretation of the findings, observations of the environment must be made and these observations will supplement those that are undertaken at the marine biological stations.

The point I wish to make is that in the development of oceanography by the nations of the Indo-Pacific region, emphasis should initially be placed on the study of the near-shore waters, and that deep-sea oceanography must wait until a staff of trained oceanographers is available. The near-shore waters are of such an enormous extent, the problems so numerous and the economic importance attached to the solution of many problems so great that the development of oceanography with the needs of the fisheries research in mind should be advanced as fast as possible.

Obituary: Prof. H.U. Sverdrup

IPFC Current Affairs Bulletin records with a deepsense of sorrow and a grave loss the sudden death on 21 August 1957 of *Monsieur le Professeur. Dr. Harald Ulrik Sverdrup*, Directeur Norsk Polarinstitutt, Observatoriegt 1, Oslo, Norway.

The Bulletin conveys its sincere condolence to the bereaved family and to the late Professeur's colleagues at the Institute. Dr. Sverdrup's loss will be greatly felt throughout the world and his splendid services to the Science of Oceanography will long be remembered.

The article by Dr. Sverdrup published in this issue of the Bulletin was received only 2 months before his death.

MARINE SCIENCES IN THE FAR EAST*

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INTRODUCTION

No doubt, the region I had to visit in the Far East is the most challenging in the whole field of Oceanology. It covers a huge area, from Taiwan to North Australia, and from the north end of Sumatra to New Guinea; and the adjacent waters of the Bay of Bengal, the Indian Ocean and the Pacific must be drawn into the picture in all aspects. This region is more complicated than any other in the world as regards its geophysical, geological and hydrographical structure, and no other region presents such a variety of plant and animal life and such a high number of new species still to be described and studied.

This challenge to all branches of oceanology becomes still more pressing when one thinks of the hundreds of millions of people of the adjacent countries who could get a better living if the resources could be explored, evaluated and utilized.

I cruised the whole region on the *Dana* from March to November in 1929 and on the *Galathea* from May to November in 1951. Besides I visited Manila and Bangkok again in 1953 and Singapore and Bangkok in 1955. Before 1929 I had participated in several cruises in Danish waters, the North Sea and the North Atlantic around the Faroes and Iceland. Finally, I may include as the background of my statements the experience from the rest of the world cruises and a 9-month expedition to the tropical coasts of West Africa in 1945-46. I have mentioned all this because it is from comparison with tropical seas apparently alike that I stress the difficulties facing any marine research in the region.

GENERAL ASPECTS

The enormous size of the area has been stressed and this is certainly in itself a problem which creates practical difficulties: an extensive area requires equally extensive observations. It means that many research institutions and many research vessels are needed; this might be called the quantitative aspect of the needs.

But any oceanologist, who has been trained elsewhere, especially in the North Atlantic or North Pacific regions, must be struck by the variety of problems in the area here considered. If we consider the South China Sea, the geophysical picture is much more complicated than

* Dr. Anton Fr. Bruun, a member of the International Advisory Committee on Marine Sciences (IACOMS) of the UNESCO, went on a tour of Indonesia, the Philippines, Hong Kong, Singapore, Malaya, Vietnam and Thailand during November-December 1956, to survey the efforts being expended in these countries in marine research, to assess the possibility of expanding these activities, and to suggest a possible plan for such expanded activities. This is Dr. Bruun's report on the survey. The survey was financed by UNESCO. The report has been made available to the *Current Affairs Bulletin* by courtesy of UNESCO.

that of the Carribean Sea, not to speak of the Mediterranean or Red Seas, which are almost simple models in comparison and much more easy to overlook. In the Far East, however, there is a long series of seas and of straits, each with its own special features. It must suffice here just to mention the Malacca Strait, the Macassar Strait, the Celebes Sea, the Sulu Sea, the Java Sea and the Gulf of Thailand. No problem of each of these areas can be solved, if it is not attacked in the nighbouring areas also. There should be a co-ordinated effort all over the area, and this requires an effort guided by highly experienced and qualified oceanologists, because this region is the most complicated in the world.

Without aiming at minimizing the value and the amount of work which has been done, and is going on in the region, the situation is that the seas of the Far East are still in the exploratory stage. The geophysical picture consists of a rough mosaic built up by observations from extensive expeditions with long intervals and intensive observations in a few restricted places and covering only a few years.

The biological picture is still more imperfect, still more at the exploratory stage. Any biologist will admit that we are far from knowing how many species of plants and animals there are in the area; how far from knowing this fundamental fact, one dare not even guess. It might be argued that such knowledge is not of urgency, if we only know the economically important species. But it is a fact that the biology of a certain fish cannot be fully understood if we have no knowledge of the systematics of all the organisms influencing it during its whole life as food, parasites, predators, competitors or otherwise. Without such a background of knowledge the present high level of fishery research in certain regions of the world could never have been reached.

To go on with fishery research in the region without a simultaneous effort to study the complicated background of hydrography and biology must mean little progress. No technology can develop in advance of results from research.

The great difficulty in suggesting a general programme of marine research lies in the fact that such a programme cannot succeed unless a variety of other problems is attacked at the same time.

Except for Singapore and Hong Kong the university training of students later on specializing in the branches of oceanology, especially the biological ones, is far from being satisfactory; there is a great need for professors who, besides teaching, are able to do research and guide the young graduates in research work. A special need in Zoology and Botany is as many teachers as possible with interest in modern taxonomy and the closely connected Biogeography. This would provide future marine biologists, especially if each university could have a field laboratory close to the sea for regular courses in marine biology.

At the same time it would provide future scientists for the staff of the necessary museums. Every single country must have a National Museum of Natural History; this is a need too often overlooked.

I have repeatedly used the term reference collection because I think that administrators perhaps then are more likely to understand that the collection is a necessary tool, and not

just a collection of rarities to be admired by the public. So each country should aim at a complete collection of the geological, botanical and zoological species of the country; this is just as necessary as the development of better libraries and a modern service of such libraries, including systematic catalogues and easy facilities for loans.

These general problems must be solved to create the right atmosphere for the students, old and young; far too often the young students, who have been abroad and enjoyed such facilities, give up in despair when they face the difficulties in these matters in their home country.

The biological oceanologists in all little-explored regions are up against much greater difficulties than the physical and chemical oceanologists. In physics and chemistry the elements and fundamental laws are identical all over the world. A good handbook of physics or chemistry can be used anywhere, bur not so those of biology.

A great number of excellent handbooks, complete illustrated treatises on the flora and fauna are available for the marine biologist, especially in the North Atlantic and the Mediterranean, but to a limited extent in the North Pacific. Since these most necessary tools are missing in the less explored regions, the biologists of such regions have to rely on the scientific papers which happen to be present in the local library, and only rarely will he be able to compare his elements, the species, with reference collections identified by a taxonomic authority. This puts the young biologists of the Far East in a much more difficult position than any of their fellow scientists in North America, Europe or Japan.

I should like to end up these general aspects by suggesting an utopian institute of oceanology for the Far East.

My review of the single countries points out that in all countries a certain potential is present, but inefficient at present. I should like to pool the qualified personnel in the best laboratory in the most suitable place, with a couple of the best research vessels, to which should be added a one thousand ton vessel, a real sea-worthy ship fit for this region of oceanic depths and heavy winds, even typhoons.

Such an institute would not be able to do more work, rather less, than say any single country around the North Sea has carried out for many years. But it would be efficient and could form a nucleus on a rational basis, where young scientists could get training in the study of local fauna and flora and their reactions to the local physical and chemical conditions in the sea. They could also enjoy a wholesome scientific atmosphere, where all branches of oceanology would be represented under the same roof or in the same vessel.

IMMEDIATE NEEDS

In trying to point out the immediate needs I shall not mention each single country, but confine myself to giving some general suggestions.

Personnel

An experienced all round oceanologist should be available as an adviser and co-ordinator for all the countries of the region. The diffuse distribution of qualified, mostly young, scientists would benefit from his advice in framing programmes, buying instruments and books, in short, in using the locally available funds in the best way.

In case, contracts with younger scientists from countries with an advanced stage of oceanology should be considered, the term must not be of less than five years, if the scientist has not been in the area before. At least any scientist trained in temperate seas must spend his first year in adjusting his former experience to suit local conditions; it may even be inadvisable to allow him too free a hand in planning during this first year.

A fair proportion of the local graduates, specializing in oceanology, must at present receive training abroad, but the biologists should preferably be trained in countries as near as possible to the region, e.g. Japan, Hawaii or Australia, or other substropical or tropical countries:

Whenever possible, training courses should be arranged in the region. They should be of a duration of not less than a month. It might be still better to get from abroad experienced oceanologists to teach for six months or one year at one of the big institutes in the region, instead of sending the young graduates abroad. This could also mean a lot of research done along with the training. In any case well trained scientific personnel is a most urgent need.

Laboratories

Except a few, the laboratories need modernization and extension; practically all need renewal of instruments and at the same time sound advice in not acquiring fanc apparatus, which should not be used until all basic and conventional work is in progress:

The International Geophysical Year has made it obvious that something must be done on an international level to facilitate free exchange of instruments on loan and perhaps even duty-free importation of scientific equipment under some responsibility or supervision by UNESCO.

In this connection mention should also be made of the great difficulties of libraries and individual scientists in acquiring books and other literature because of currency restrictions. The UNESCO system of coupons should be publicized as much as possible. All other UNESCO activities about libraries should be intensified as much as possible, especially in procuring central card-indexes. Even with my fairly detailed knowledge of the countries, I have had great difficulties in deciding to which library I ought to send a complimentary copy of e.g. the *Galathea Report*. It would be very useful if UNESCO (perhaps in collaboration with FAO) could issue a list of libraries, where one has a certain assurance that the books will be well kept and catalogued, and available for any scientist in the country. I might use my own country as an example. If only one copy of a book on Natural Sciences and Medicine is offered to Denmark it goes to the University Library of Copenhagen; from here it may be ordered, even by telephone, by any citizen in Denmark. But this arrangement would not be known by all. Therefore an annotated world-list of the most important libraries would be very useful.

Research Vessels

Some of the research vessels are as good and modern as they should be, but no country has a really sea-worthy and powerful vessel, which could accommodate the scientists and the necessary instruments and gear for reasonably long cruises, which are so much needed in this huge area. Each single government should be informed that marine research, including exploratory work for the extension of marine resources, cannot be carried out without vessels and also the necessary funds for using them. The expenses of running at least one good research vessel would be only a small fraction of what each of the countries spend on the naval ships.

Co-ordination of Work

The Indo-Pacific Fisheries Council might be approached about having a pure research section of oceanology. This might yield the first step of the much needed co-ordination of the research work, at a later stage an independent regional body.

A first occasion for discussing this problem would be the Pacific Science Congress (PSC) in Bangkok in November 1957, where advice could be given by the members of IACOMS.

Whatever action UNESCO may decide to take in furthering the oceanological research in the Far East, the IACOMS meeting and the PSC may be suggested as an excellent occasion for discussing such a programme, and perhaps obtaining further suggestions.

UNESCO's regional meetings or symposia, like that I experienced in Vina del Mar, are very useful in this and many more respects and I can only strongly recommend this activity.

LONG-TERM PROGRAMME

It is to be hoped that the research programmes going on, or to be started in the near future, on a national basis and/or on the initiative of UNESCO, will soon be expanded.

At the same time the research programme should be freed from the too-firm grip which the fisheries departments exert on the existing programmes with very little understanding of the value of the basic research. I need not stress this point more than by emphasizing how extremely little we would have known about the region, had it not been for the exploratory research carried out by several nations totally disinterested in the exploitation of the marine resources of the region.

The Philippines and Indonesia are in a special position because of the wide, in the case of Indonesia even vast, extent of their waters. As soon as they have a central national institute of oceanology at work, they must have smaller branch institutes to undertake local observations which could never be satisfactorily carried out from a central institute. The Philippines might start with one in Zamboanga and Indonesia with one in Ambon. This may sound ambitious, but if these countries want the same level of knowledge of their own natural surroundings as advanced modern civilization, it must be done. Japan is a nearby example of a nation which has shown a full understanding of this challenge to modern man.

To obtain anything in this respect I see no other way than to intensify the propaganda for making the people understand that no progress is possible in the long run without research.

In most universities very little research is carried out in the natural sciences. The professors are mostly too much tied up with teaching. But on occasions when I expressed my view, that the time has now come when national effort should be directed to research work in the universities, I found considerable understanding of its importance.

I am well aware that UNESCO is working fully on this line in many ways. For the special field of the marine sciences, I am still more convinced of the necessity of an international research vessel than when I put forward the plan in Tokyo. My travelling in India, Ceylon, and Pakistan in 1955, and this last trip to the Far East have especially helped bring into focus the desirability of such a vessel for training of local scientists and the recognition of the importance of the marine sciences.

Even if the plan for an international research vessel materializes, I would like UNESCO to examine the possibilities of getting the countries I visited to collaborate for a regional research vessel. Again the Bangkok meeting might present the occasion where the local opinion about such a plan could be sounded.

Acknowledgement

I am grateful to UNESCO for financing this survey. I am also indebted to all my colleagues and friends, old and new ones, for the cordial way I was treated in all the countries. Names are too many to be mentioned here, but their friendly collaboration is the background of this Report which, I hope, will bring the marine research another step forward.

In Lighter Vein

No More Fishy Story

Anglers will have no excuse for "the one that got away" if they use a new water-pistol technique developed by two American scientists. The technique involves an anaesthetic called "M.S. 22". A sea-water solution of this drug is sprayed over a fish thrashing on the end of the line, stunning it within a minute. *(Reuter, Washington, 2 August 1957).*

How Fishy Can One Get

Fish rained down from the sky in the Indian village of Razapur, near Ghaziabad, about 20 kilometres (about 12 miles) from New Delhi, correspondents of several Delhi newspapers reported today. Some of the fishes found on roofs of buildings measured up to about 1 ¼ inches. The current heavy rains, unusual at this season of the year, carried the "flying fish" towards a lake near the village. *(AFP, New Delhi, 16 September 1957).*

GENERAL NEWS

World Fish Catch Approaching 30,000,000 Tons A Year, Reports FAO

The total world catch of fish continues to increase and is now approaching 30,000,000 metric tons a year, according to figures published in the latest volume of the *Yearbook of Fishery Statistics*, 1955–56, Vol. VI, just issued by the Food and Agriculture Organization (FAO), Rome, Italy.

The figure recorded for 1956 by FAO is 29,330,000 metric tons. The continued increase in the world catch of fish is indicated by the following figures (in metric tons): 20,440,000 in 1938; 19,160,000 in 1948; 24,750,000 in 1953; 26,690,000 in 1954 and 27,940,000 in 1955.

There are now eight countries catching more than 1,000,000 tons of fish yearly, India having reached this total for the first time last year. Japan remains far in the lead as the No. 1 fishing country. The first eight account for 62.1% of the world catch; the remaining 26 countries listed in the *Yearbook* catch 30.4% of the total.

Total Annual Catch: Eight Major Fish-producing Countries, 1938, 1948, 1953-56

Countries	%*	1938	1948	1953	1954	1955	1956
		— Thousand metric tons (Live weight) —					
WORLD GRAND TOTAL	**100**	**20,440.0**	**19,160.0**	**24,750.0**	**26,690.0**	**27,940.0**	**29,330.0**
(Countries catching million tons and more annually)	*62.1*	*12,730.0*	*11,840.0*	*15,260.0*	*16,800.0*	*17,370.0*	*18,220.0*
1. Japan	16.3	3,562.0	2,431.4	4,521.6	4,544.6	4,912.8	4,762.5
2. United States[a]	10.0	2,253.1	2,409.9	2,437.5	2,706.4	2,738.9	2,935.9
3. China (mainland)	9.0	1,500.0[b]	(448.0)	1,890.0	2,294.0	2,518.0	2,640.0
4. U.S.S.R.	8.9	1,523.0	1,486.0	1,983.0	2,258.0	2,498.0	2,617.0
5. Norway	7.3	1,152.5	1,504.0	1,557.1	2,068.2	1,813.4	2,128.9
6. Canada[c]	3.7	836.8	1,052.9	925.1	1,025.8	954.1	1,076.9
7. United Kingdom	3.6	1,198.1	1,206.1	1,122.0	1,070.2	1,100.4	1,050.4
8. India	3.4	—	—	819.0	828.5	839.0	1,012.3

* Catch as percent of Grand Total based on 1956 figures or latest year shown.
a Includes Alaska, *b* Data for 1949 shown under 1948, *c* Includes Newfoundland.

Perhaps the most interesting statistics in the mass of information published in the *Yearbook* are those giving details–released for the first time to the Western world–of the fishing fleets of Soviet Russia. There are now more than 60,000 craft in the U.S.S.R. fishing fleets, of which 1,785 are trawlers.

Herrings, sardines, anchovies, etc. make up the largest section of the world catch by

species, 6,990,000 metric tons, according to the *Yearbook*. Next in order come mixed and unidentified fish, 5,240,000; cods, hakes, haddocks, etc., 4,880,000; and fourth, freshwater fish, 3,070,000 metric tons.

Asian countries account for 11,830,000 tons of the world total catch. Europe comes second with 7,970,000 tons, and North America third with 4,180,000 tons, U.S.S.R., fourth, accounts for 2,620,000 tons.

Most of the approximately 10,000,000 tons increase in the world catch since World War II (19,160,000 tons in 1948; 29,330,000 tons in 1956), has taken place in Asia where the total catch has risen by more than 5,000,000 tons—from 6,580,000 in 1948 to 11,830,000 tons in 1956. The next biggest increase has been in Europe where the total in 1956 was 7,970,000 tons as compared with 6,140,000 tons in 1948, a rise of more than 800,000 tons. The U.S.S.R. catch has increased by more than 1,000,000 tons over the same period.

As in previous issues, the latest *Yearbook* contains statistics on catches, landings (by weight and value), disposition of catches, production of preserved and processed commodities, fishing craft and whaling from all countries. Improved reporting from various countries is reflected in refinements and extensions of several tables.

As before, the *Yearbook* (with English, French and Spanish text) will be available throughout the world at $3 or 15/-, or the equivalent of that sum in any national currency.

Mariculture to Increase World Food Supply

A new concept has recently appeared as "Mariculture", meaning the utilization of the food resources of the sea using the techniques worked out and employed so successfully in modern scientific agriculture. Some marine laboratories are now beginning to take on the look of young agricultural experimental stations. Animal breeders, accustomed to working with cattle and poultry, are investigating the chances of creating better strains of fish, shellfish, and shrimps. The Rockefeller Foundation of the U. S. A. is sponsoring such a preliminary study on marine animal breedings. Biochemists are starting work on nutritional requirements of marine animals for possible use in cultivation.

All these stem from a genuine concern that the earth's human population may outrun the food supply at some seemingly inevitable future date unless something is done to change the picture.

One possible solution lies in the more effective use of the food already being produced by the world's green plants, the ultimate source of food. It has been estimated that some 500 billion tons of solid plant matter are made each year by green plants through photosynthesis. Man uses only a minute fraction of this amount.

Only one-tenth of this phytosynthesized food is produced by land plants. Ninety per cent of the world's food is made by marine and freshwater algae, mostly marine. On land nearly all food production is based on agriculture, in which the materials furnished by nature are controlled, improved and cultivated by scientific methods. On the othet hand, the meagre amount of food taken from the sea today is found in the wilderness of the ocean. Scientists say that "Compared with agriculture, the marine fisheries are still in the stone age."

The field of marine culture is a pioneer one, but properly developed this might help

develop that almost untouched 90% of the earth's photosynthsiezed material produced in the sea. This in turn may go a long way to feed properly the under-fed and the thousands of hungry mouths born everyday on this planet. *(Science Newsletter,* 8 June 1957*).*

New Technique for Electrical Fishing

A new fishing technique makes use of the principle of electrotaxis—the tendency of fish, when placed in an electric current, to go from the negative pole, or cathode, to the positive pole, or anode. Electrotaxis may be used during all the seasons, independently of the condition of the fish. In addition, a weak alternating current agitates the fish and causes them to withdraw from the area. Thus, these phenomena may be used to more or less guide the fish.

After preliminary testing at the Ozerna River experimental station in Kamchatka, U.S.S.R., an electrical fishing system was installed in the Iavina River. This system caught 961 quintals (about 107,600 pounds) of fish in 169 hours as compared to 657 quintals (73,600 pounds) caught in the same time interval by a crew of fishermen using nets.

The end of an intake tube is wired to the positive pole of a direct-current hight voltage generator. Sheets of metal placed around the end of the intake tube are wired to the negative pole of the generator. The fish, guided by the existing electrical field, swim toward the near end of the intake tube. It might be thought that instinct would cause the fish to swim away from, rather than toward, the intake tube, but electrotaxis apparently overcomes the instinctual tendency of flight. The fish swim into the intake tube and are, in a matter of seconds, drawn into the intermediate reservoir.

Fish thus caught are, to all appearances, the same as before and apparently are not damaged. After being caught electrically, they have been kept alive for as much as five or six days.

For best results, the water should be made slightly saline and its resistence should measure between 1,000 and 10,000 ohms per centimetre. If the resistence measures above 10.000 ohms, the results are not too good. The electrical fishing system has no influence on fish at a distance greater than 3.5 metres (11.5 feet). This limitation has been made use of in that a certain number of fish are allowed to pass upstream, thus insuring adequate spawning.

The intake tube of the pump is 21 metres (almost 69 feet) long. The pump is large enough to engulf the fish. They pass from the pump through the intermediate reservoir and, finally—still drawn by the flow o water—they arrive at the cutting table. They are transported from here on a conveyer belt system to salting vats.

Experience has shown that fish caught electrically do not have grains of sand in their gills or under their scales as is the case when caught by net. Because of this, a portion of the fish are taken directly from the reservoir and are shipped by tank truck to a canning plant six kilometres away.

The entire fishing installation requires 40 to 45 kilowatts of current to run it, of which 6.5 kilowatts are used in the electrical fishing itself.

The river barrier is made up of metallic rods, 7 to 8 millimetres (0.28-0.31 inch) in diameter, and 28 to 30 millimeters (1.1-1.2

inches) apart. These rods are set in wooden frames held by poles. Every fourth or fifth rod is charged with a weak alternating current. In spite of the comparatively great distance between the electrical rods, the fish do not approach the barrier.

As of now, the use of noise to guide the path of the fish has not been studied. It would be interesting to study the behaviour of fish when subjected to sounds of varying frequencies. These sounds might be transmitted great distances through the water with relatively little dispersal. By this means, it might be possible to lead fish to the intake of a distant pump.

One of the advantages of electrical fishing is that young fish are not influenced by the electrical field; it takes a much stronger field current to affect them. Selective fishing can also be done electrically where only certain kinds of fish are taken. This possibility has been verified experimentally. (*Commercial Fisheries Review*, **19** (7): 32-34, 1957).

More Fish with Fewer Watts

An Italian fisheries expert reports that he has successfully demonstrated to Tunisian fishermen that they can catch more fish with less wattage by setting their fishing lights underneath the water rather than above the surface.

Captain Luigi Farina, who was in Tunisia on a two-month FAO assignment, said that he found fishermen using strong petrol engines to generate power for a great number of surface lamps in their night fishing for sardines and anchovies.

"In Mahdia, for instance, one had 24 light bulbs of 500 watts each. Another had 16 and a third boat had 12. But most of the light from these lamps was wasted as it was reflected by the surface of the sea".

"In fact, when we were at sea we were illuminated like a city square, but fishing results were poor".

Captain Farina demonstrated a different technique, using a 32-volt generating set and a 500-watt lamp placed under the water.

"We were so successful in attracting fish that the local fishermen asked us to change their system so that they could use their lights under water," he said.

Besides saving 50 percent in fuel costs, the submarine lights make for more-effective fishing in rough seas and in strong moonlight.

Captain Farina demonstrated that the submarine lamp is even more effective when used with an echo-sounder. The echo-sounder, he said, reduces waste of time because the fisherman can use it to make sure that worthwhile shoals of fish are present before he anchors and switches his lights on. (*FAO Bulletin*, No. **2**, 1957)

Surf-landing Fishing Boat

The FAO designed surf-landing boat is nearing completion at the shipyard of Askvlegs Bros., Lundegrand, near Bergen, Norway. A second prototype, built of hard wood, is on order at the ADC Boatyards, Sekondi, Ghana. It is understood that Ceylon intends to place an order for a third prototype in Colombo. In this connection Ceylon sought and was given FAO advice on the selection of material for construction and on the size of engine.

Nuclear Radiations for Preservation of Fish

The "Atoms for Peace Programme" and the new atomic age with its potentially revolu-

tionary effect on food processing are being increasingly brought home to the fishing industry through studies on the use of nuclear radiations for the preservation of fish. The technique of food preservation using atomic energy is based on the use of radiation to destroy organisms which cause food spoilage. Experiments on human food preservation by radiation are being conducted at present in several countries, chiefly, U.S.A., U.K., U.S.S.R. and Japan.

Two processing techniques, "radio-pasteurization" and "cold-sterilization," born of studies in atomic energy and promising possible enhancement of the iced-storage life of fish, are under study at the five technological laboratories of the US Fish and Wildlife Service's Bureau of Commercial Fisheries. Contract research work on this problem is also under way at the Massachusetts Institute of Technology, Oregon State College, Food Chemical Research Laboratories, Florida State University, and Maryland State College.

The present study is primarily a screening operation designed to select, for possible initial commercial utilization, those of the edible species of fish and shell-fish that are most adaptable to the proposed new processing methods. High intense levels (1 to 3 million *rep.**) of electromagnetic (gamma) radiations and of ionizing (electron) radiations are being used to study the feasibility of "cold-sterilizing" the fishery product, that is to kill all bacteria and spores without recourse to the steam-sterilization processes commonly used in present-day operations. Lower levels (100,000 to 1,000,000 *rep.*) of both types of radiation are being used to kill the great majority of the active bacteria and thus to extend the possible iced-storage life of the product over that normally attained through the use of ice alone. The relative efficiencies of the two types of radiation and the two types of processing will be compared and evaluated in terms of commercial utilization. Radio-pasteurization, the low-level radiation technique which kills a majority of the bacteria in a product, appears to be the most promising process and is being emphasized in these studies. Coupled with other processing methods such as refrigeration and prepackaging, this technique may revolutionize the present methods of marketing, making available fresh unfrozen fish of a quality equivalent to that enjoyed by coast and lakeshore dwellers.

However, radiation preservation has limitations. While the radiation sterilization process will kill bacteria, off-flavors and off-odours tend to result from applications large enough to kill all bacteria. Furthermore, the radiation preservation process will probably be used in conjunction with refrigeration, thermal preservation, or other preservation processes. The time scale of development to date indicates that within 5 years radiation preservation of some foods could begin on a practical commercial scale. Widespread commercial use of this technique must await development of cheaper sources of radiation energy and packaging technique.

Radiation preservation of food does not appear likely to replace other methods of food preservation to any substantial extent in the near future. When the technology has been developed and is economically feasible, this method of food preservation probably will be a supplement to the other methods now available. The potential for small business probably will develop slowly, will be moderate in size and will be in connection with food processing and packaging. *(Commercial Fisheries Review,* 19 (7), p. 5 and 15, 1957).

* "*rep.*" means roentgen equivalent, Physical = amount of radiation absorbed equal to 93 ergs per/gram in unit density material.

NEWS FROM MEMBER GOVERNMENTS

AUSTRALIA

Occurrence and Distribution of Tuna

Data from the tuna longlining cruises of the F.R.V. *Derwent Hunter* support the hypothesis that the tuna species are segregated according to water mass distribution, and in particular, southern bluefin tuna are controlled by the degree of vertical mixing between the sub-Antarctic and the Central Tasman water masses.

A detailed study of a limited region during the tuna season lends support to the theory that the regions of the major surface schools of tuna are determined primarily by the interaction between two water masses. The data indicated that the main surface schooling tuna were held to the north of the area investigated by a persistent intrusion of cold water from the south.

Pearl Culture Experiments Successful

Experiments with Australian species of *Pinctada* carried out at the CSIRO Field Station, Thursday Island, for culturing pearls have proved successful. In these experiments *P. maxima* was chosen because its large size offered scope for culturing large pearls (10-15 mm. diameter) which would compete on the world market.

Both "half-pearls" and "graft-pearls" have been cultured. So far, 100 nuclei have been inserted by each method. Post-operative mortality was of the order of 10 per cent for the graft technique and 1 per cent for the half-pearl technique.

Of those oysters treated by the graft method, 40 have been recovered so far, and eight of the nuclei were found. Three of these had become noticeably covered with nacre during the nine months.

Subsequent experiments showed that loss of nuclei occurs within a week of operation; the external epithelium covering the nucleus contracts and ruptures, allowing it to escape. This can be prevented by embedding the nucleus deeply in the non-muscular connective tissue of the stomach.

Of the nuclei inserted for half-pearl culture, 70 per cent were retained. Periodic sampling showed that they became cemented to the shell within a month, and completely covered by nacre in three. The earliest nacreous secretions were often discoloured, but later these became coated with fine nacre. It is estimated that a half-pearl would reach marketable quality in 9-12 months.

This represents the first production of cultured pearls in Australia.

Handbook of New Guiena Fishes

Mr. I.S.R. Munro of CSIRO Division of Fisheries and Oceanography is preparing a *Handbook of New Guinea Fishes and a Check List of New Guinea Fishes* for publication by the Department of Agriculture, Stock and Fisheries of the Territory of Papua-New Guinea. This work was requested by the Department of Territory.

A *Handbook of Australian Fishes* prepared by Mr. Munro has been appearing in parts for sometime in the *Fisheries Newsletter*. Mr. Munro is also the author of *The Marine and Freshwater Fishes of Ceylon* published in 1955 by the Department of External Affairs, Australia.

CEYLON

Growth-rate of Gouramy

Simple experiments on the rate of growth of gouramy fry in relation to feed and water condition were conducted in the laboratory at the Fisheries Department. Young fry obtained from Watapitiwala were used in these experiments.

Results obtained so far have indicated that (1) fry fed on zooplankton grow much faster than those fed on phytoplankton; (2) fry about three weeks old start feeding heavily on small shrimps, worms and fry (very young ones) of other species of fish; and (3) their carnivorous feeding habit persists even when the fry are 2.5 months old, with no indication of changing into plant feeding. Apart from sufficient supply of food and oxygen, quick elimination of metabolic waste material by frequent changing of fresh water has been observed to be an important factor in ensuring fast growth rate.

Kissing Gouramy Spawns in Experimental Ponds

Spawning of kissing gouramy has been successfully carried out at the Fisheries Department experimental ponds. Over 10,000 fry have been obtained from such spawning.

It has been observed that fry started taking food as early as when they were only about 2 days old (2 days after hatching), before the yolk sac had been completely absorbed.

It has also been observed that during this early feeding stage most of the phytoplankton ingested passed through the alimentary canal undigested, while practically all the protozoa eaten were digested.

Fry fed with zooplankton showed much faster growth rate than those fed with phytoplankton. In fact fry fed principally on phytoplankton were weak and suffered high mortality during the first two weeks.

INDIA

India's Fish Catch Tops One Million Tons A Year

For the first time, India's total annual catch of fish has exceeded one million tons, according to the *Yearbook of Fishery Statistics*, 1955-56 (Vol. VI), published by the Food and Agriculture Organization (FAO), Rome Italy. The figure was 1,012,000 metric tons in 1956 compared with 839,000 metric tons in 1955.

The breakdown of the landings in India by selected species are:

Fish Landings in India by Major Species

Species	1938	1948	1953	1954	1955	1956
			— Thousand metric tons —			
Anchovies, wolf-herrings, oil-sardines, etc.	—	—	104.2	87.9	94.4	64.9
Mackerels *(Rastrelliger)*	—	—	70.8	28.3	22.8	16.4
Ribbonfishes (hairtails)	—	—	56.3	29.6	32.7	24.5
Carangids (jacks)	—	—	7.2	16.4	18.4	56.6
Bombay duck *(Harpodon)*	—	—	45.3	36.1	104.1	128.9
Marine prawns, shrimps and other crustaceans	—	—	90.7	154.2	106.6	159.6

India has now joined the select few—eight countries with an annual catch running into seven gures. (For the pro duction figures of these eight countries see Table on p. 9 of this Bulletin).

India is now the third Asiatic country in the group of nations catching more than a million tons of fish a year, the other two countries being Japan and China mainland.

Carp Spawning Experiments

Investigations on the study of the effect of fish pituitary glands on the spawning of Major Carps and other freshwater fishes have been initiated at the Central Inland Fisheries Research Sub-Station at Cuttack since 1955.

The glands, sorted species-wise, were preserved in absolute alcohol and kept under low temperature in a refrigerator. Intramuscular and intra-peritoneal injections were tried. The injected fish generally spawned within 6-8 hours after the injection. Cool rainy days have been found conducive to spawning and injected fish generally did not spawn on hot, sunny days.

The experiments were successful in the case of *Labeo rohita*, *Cirrhina mrigala*, *Labeo calbasu*, *Labeo bata*, *Cirrhina reba*, and *Barbus sarana*.

Developmental stages of eggs and hatchings of all the species have been collected. The hatching rate was sometimes as high as 95%. The doses of injection required to induce spawning appear to depend on the size of of the breeders. When injected intramuscularly, a much smaller dose appeared to be sufficient to induce spawning than when the injection was given intraperitoneally.

It was observed that rohu *(Labeo rohita)* pituitary gland induced successful spawning not only in rohu but also in *L. calbasu*, *L. bata*, *C. reba*, and *B. sarana*. Similarly catla *(Catla catla)* pituitary gland was found successful in *C. mrigala*, *C. reba* and *B. sarana*.

Further experiments are being carried out to standardize the dosage and frequency of injections for particular species and sizes of fish so that spawning could be assured.

Calcutta Fish Seed Syndicate

The Fish Seed Syndicate at Calcutta supplied about 11,200,000 fry, 26 'kunkas' and 153 bags of spawn by rail and air to various states in India, Nepal and Malaya in the year 1957 (till September) as against nearly 870 thousand of fry and 16 kunkas of spawn in the year 1956.

About 6,000 catla fry were supplied to Malaya where they were required by the Government Fishery Department for experimental purposes. Six air consignments consisting of 66,000 carp fry were despatched to Nepal during the season for fish culture in that country.

About 2,000 English carp fingerlings *(C. carpio)* obtained by air from Bangkok, were repacked in oxygen and despatched on to Cuttack (Orissa State) by rail successfully for experiments at the Central Inland Fisheries Research Sub-Station there.

Oxygenated tins that were being used for the last few years for fish fry transport by air have been replaced by plastic bags packed in paper cartons or tin containers. The shape of the bag has been specially designed so that the sealed bag loaded with water, fish fry and oxygen may just fit in the carton or the tin container. The packing of a bag has also been simplified in such a way that at least 200 loaded bags may be supplied in a day with negligible mortality.

Central Fisheries Technological Station

A Central Technological Station has been established at Cochin (Kerala State) in August 1957. The Station will undertake experiments for developing improved types of fishing gear and fishing craft. Investigations will also be made on the design, comparative efficiency, preservation and on the materials employed for the construction of fishing gear. Attention will also be paid to the hull design of fishing boats and vessels, engines and machinery for mechanization, navigation equipments, seamanship and methods of locating fish.

A wing of this Station will also take up researches on fish processing and utilization of fish products and will evolve commodity standards and grades for various fishery products in order to ensure good quality of fish and fish products for sale in the markets. The location and work of this Wing of the Station is under consideration.

Exploration of Shrimp Resources

Exploratory trawling operations conducted by the Madras Fisheries Department vessels off Madras, (opposite Ennore Estuary) and off Tuticorin have located rich shrimp grounds. So far, over 200 tows have been made in the region between Tuticorin and Tiruchendur. The maximum catch per hour recorded is 450 lb. out of which nearly 100 lb. were of good quality (10 to 15 per lb. with head on). These explorations are being continued.

Mechanized Boats

The Madras Department of Fisheries has been supplying mechanized fishing boats constructed by a private firm to Fishermen Co-operative Societies and Federations on a hire purchase system. These boats popularly called 'Pablo Boats' are constructed according to the designs prepared by Mr. P. Zeiner during his assignment in India as an FAO/ETAP expert. These boats range from 22′ to 32′ in length, cost approximately Rs. 10,000 each and operate mainly gillnets designed by another FAO/ETAP expert, Mr. Illugason. The average income of a fisherman working on such a boat ranges from Rs. 120–200 per month, as against the normal income of Rs. 30–50 per month per fisherman on a country craft. Already 50 such boats have been supplied to the various Societies and Federations and the demand has been steadily increasing.

The Second Five-Year Plan provides Rs. 100,000 for construction of a boat yard by the Government of Madras at Tuticorin.

Construction of such a yard will to a great extent meet the demands in Madras for mechanized fishing boats of improved designs. It is also expected that the cost of a boat constructed at this yard will be much less than at present charged by private firms.

Fishing Gear and Methods

Mr. John L. Burroughs assigned to India arrived in February 1957, as Fishing Gear Technician under the T.C.M. Programme of U.S.A. to instruct local fishermen in the preparation and use of modern fishing gear in Bombay. He will also be responsible for the upkeep, repair, alteration and construction of various types of fishing gear at the Deep Sea Fishing Station in Bombay.

Mr. Charles L. Kaufman, Master Fishermen arrived in India in January 1957 on an assignment under T.C.M. to demonstrate gillnetting, longline fishing, trolling, etc. He will be attached to the Government of India Deep Sea Fishing Station at Bombay.

Inland Fisheries Training Course

A Training Course in Inland Fisheries is being annually conducted since June 1948 at the Central Inland Fisheries Research Station, Calcutta, India. The Course which commences from 1 April every year lasts 10 months* representing a total of 200 working days with an average of 4.5 hours of instruction every day. The Course is intended mainly for junior technical staff of the Central as well as State Fisheries Departments. A few private candidates are also taken. So far, 130 candidates have been trained at the Centre. Till 1956 about 20 candidates were admitted to the course every year but in view of the enhanced requirements under the Second Five-Year Plan, the number has been increased to 35 candidates.

The training consists of lectures and demonstrations at the Research Station and during a comprehensive study tour of all the important fisheries centres in India. The syllabus covers a wide field consisting of: General Biology of Fish; Plankton; Important Fisheries; Fish Farming Procedures and Management; Fishing Craft and Gear; Fish Processing and Preservation; Fisheries Statistics; Marketing and Socio-economics; Elements of Fisheries Research; Laboratory Techniques; etc. Considerable stress is laid on practical aspects of fisheries work. Of the total 900 hours, 400 are devoted to theoretical instructions as against 500 to practical work.

Although at present there are no foreign students, provision exists for acceptance by such students for the Course. Hostel facilities are available.

Training in Fishing Boat Constuction

The Government of India established in July 1957 a Training Centre at Cochin to train Fisheries Officers of the maritime States in designing and construction of improved types of small mechanized fishing boats. The Centre is being conducted under the supervision of Mr. Paul Zeiner, FAO/ETAP Naval Architect. Nine participants, most of whom were working as counterpart assistants to Mr. Zeiner, were deputed by the States of Bombay, Mysore, Kerala, Madras, Orissa and West Bengal. The Centre is due to terminate by the end of December 1957.

Training in Mechanized Fishing

A Centre for training fishermen in mechanized fishing has been functioning at Tuticorin, Madras, for well over a year. This Centre was initiated by Mr. P.A. Lusyne, FAO/ETAP expert, in May 1956. The Centre trains at a time 20 active fishermen, in various aspects of mechanized fishing including elements of navigation. Two batches have already been turned out and a third batch is currently undergoing training. On successful completion of the training, the participants of the two previous batches were readily absorbed in the industry.

INDONESIA

Studies on Shrimps

While exploratory trawling for shrimps continue along the east coast of Kalimantan (see *Current Affairs Bulletin*, No. **19**:18, July 1957), a project has been started to study the early life histories of the commercial shrimps. To date 23 surface plankton tows have been completed.

* Ten months for post-graduates, twelve for under-graduates.

The penaeid larvae collected belong to the mysis stages only, and these remain unidentied. Surface sea water temperatures were taken concurrently with plankton hauls, as were some water samples for salinity determinations.

To study the post-larval and juvenile stages of shrimps, samples were taken from push-net catches made in the shallow water region of the Djakarta Bay. It was found that over 90% of the catch is composed of the species *Acetes vulgaris* (Family, Sergestidae); apart from negligible numbers of small fishes, the remainder consisted of specimens of *Metapenaeus monoceros*. To date this has not proved to be an effective way of obtaining appropriate samples of young penaeid shrimps.

An attempt is also being made to identify the species of penaeid shrimps which are important commercially.

Programme in Fisheries Biology

A programme has been devised and a start already made for the study of the biology of commercially important fish.

Stolephorus: Weekly sampling of catches from seros is being carried out to determine length, weight, sex, condition of gonads, and diet. In *Stolephorus indicus*, samples taken from June to August show increases in the means of standard length and weight, indicating growth in this period. In three species examind *St. indicus*, *St. commersonii*, and *St. heterolobus*, the sex ratio was found to be about equal, and the gonads were not mature. Examination of stomach contents has shown the main food to be diatoms and copepods.

Clupea: A compilation has been made of monthly landings of the 'lemuru' *(Clupea)* fishery from 1951 to 1956. Records to show the fishing regions from month to month are available, and these have been placed on maps. A re-examination of length frequnecy data collected during the height of the 1953-54 fishery has been started.

A study of rainfall records from appropriate stations in East Java has been started to determine the effect of this climatic factor upon the success of fishing.

Decapterus: A decline in landings of these fishes has been reported. Statistics are being compiled from all the fishing regions around the Java Sea to determine whether a decline has occurred and if so, whether it has been of a general nature or confined to specific areas. Again asin the 'lemuru' study, weather records have been compiled.

JAPAN

Japanese Fish Catch Greatet in World

Japan continues to be the greatest fish catching nation in the world, according to the *Yearbook of Fishery Statistics*, 1955-56 (Vol. VI), published by the Food and Agriculture Organization (FAO), Rome, Italy.

While the figure for the total annual Japanese catch for 1956 is slightly down at 4,763,000 metric tons as compared with 4,913,000 metric tons for 1955, it is still some 1,800,000 tons higher than that of the second biggest fishing country, the United States (including Alaska), which caught 2,936,000 metric tons in 1956.

The *Yearbook* gives the following breakdown of the fish landings in Japan by selected species:

Fish Landings in Japan by Major Species

Species	1938	1948	1953	1954	1955	1956
	—	Thousand metric tons		—		
Salmons	243.4	8.7	43.0	76.3	175.5	151.3
Alaska pollack	194.1	183.8	225.3	241.6	231.2	234.9
Anchovies	—	—	243.5	304.0	391.5	346.7
Herrings and round herrings	43.4	192.0	397.7	180.3	113.2	95.5
Sardines (pilchard)	1,084.5	375.4	343.6	245.6	211.4	206.3
Albacore	59.0	25.6	52.0	55.9	48.4	65.8
Bigeye tuna	—	—	29.2	25.8	42.1	49.1
Mackerels	133.2	98.5	234.8	297.4	244.4	266.2
Skipjack	120.8	40.7	72.7	99.8	99.6	98.0
Yellowfin tuna	—	—	35.9	52.9	67.7	80.9
Jack mackerel, scads	29.6	29.6	239.9	251.2	238.5	246.6
Atka mackerel	—	—	158.5	113.8	113.7	121.1
Saury	—	—	253.7	292.7	497.0	327.8
Common squids	105.9	301.3	420.1	398.8	383.4	291.0
Devilfishes	23.8	21.7	41.9	43.8	47.6	47.0

The *Yearbook* also gives the following details of the Japanese fishing fleet:

Japanese Fishing Fleet

Category		1938	1948	1954	1955	1956
	N	—	452,089	430,950	415,533	416,697
	T	—	1,055,579	198,187	1,262,764	1,340,004
Non-powered craft in non-tidal waters	N	—	39,425	29 508	27,710	27,396
	T	—	18,710	14,413	13,511	13,064
Powered craft in non-tidal waters	N	—	1,094	1,994	2,156	2,247
	T	—	1,615	2,909	3,079	3,175
	P	—	4,805	9,246	9,599	10,085
Non-powered craft in tidal waters	N	—	307,135	262,377	243,457	237,179
	T	—	293,839	266,997	247,437	236,997
Powered craft in tidal waters	N	—	104,435	137,617	142,210	149,875
	T	—	741,415	913,868	998,737	1,086,768
	P	—	1,823,485	2,508,537	2,712,699	2,925,468
Under 5 tons	N	—	80,233	110,521	115,640	123,318
	T	—	146,020	200,117	208,806	222,137
	P	—	493,500	715,881	755,793	803,890
5-19 tons	N	—	18,766	19,518	19,190	18,905
	T	—	205,349	212,458	209,551	207,305
	P	—	604,447	660,244	657,940	657,104
20-99 tons	N	—	5,003	6,448	6,664	6,856
	T	—	239,786	305,687	327,797	347,325
	P	—	560,893	856,192	945,456	1,034,904
100 tons and over	N	—	433	584	716	796
	T	—	150,260	195,606	252,583	310,001
	P	—	164,445	276,220	353,510	429,570

N = Number of craft, T = Tonnage, P = Power

New Fisheries Development Plan

In September 1957, the Ministry of Agriculture and Forestry of Japan made public a "White Paper" outlining a new general plan for agriculture, forestry and fisheries which is intended to be carried out until the end of 1975. The objective of the plan is to enforce basic measures for stabilization of the living of farmers and fishermen through increased production and increased earnings.

The important aspects in the field of fisheries specified in this plan include (1) stabilization of coastal fisheries management through appropriate and timely measures for propagation of fish, improvement of coastal fishing grounds, prevention against water pollution, intensive use of fishing grounds and diversified, operation of fisheries; (2) advanced modernization of fishing craft and technique; (3) improvement of fishing ports and their ancillary equipment; (4) accelerated activities of fishermen's co-operatives and similar organizations; and, (5) extension of markets for marine products, improvement of fish distribution system and stabilization of fish prices.

Silver and Grass Carp bred in Japan

Pains-taking research for 14 years in artificial spawning of grass and silver carp by Prof. Denzaburo Inaba of Tokyo University of Fisheries and other fisheries scientists of Japan has untimately paid. Until recently, it had been believed almost impossible to breed these carps outside the waters of the Yangtze and Pearl Rivers in China. Prof. Inaba and other workers of Prefectural Fisheries Stations have discovered in the past several years that these carps released in the Tone River near Tokyo during the War were multiplying. In July 1957, these same workers and members of the Freshwater Fisheries Research Laboratory, Japanese Fisheries Agency, collected naturally fertilized eggs of these carps from the same river and hatched them successfully in the laboratory as well as in the specially designed hatching apparatus. Eggs taken from mature fish collected from the Tone River at nearly the same time were also artificially fertilized and hatched in the same way as in the case of eggs collected from river water. Fry so raised by now measure 10-15 cm. and total some 20,000.

Further studies to make the propagation of these carps independent of fry supply from the Yangtze region are being continued.

Radio-activity and Fisheries

Substantial researches on the utilization of atomic energy in the field of fisheries have already been pushed forward in such fields of study as preservation of the freshness of fish by the use of radio-active isotope. The effects of radio-active wastes on fish and possible counter measures are also being studied.

Some of the fisheries research institutes and universities in Japan have also been utilizing, on an experimental basis, atomic energy for the purpose of fish breeding, feed-stuff improvement for cultured fish, prevention of discolouration in cured fish products, and intensified gelation of agar-agar, etc. The results of these studies are awaited.

Thai-Japanese Taru Tau Island Development Project

In 1956 the Government of Thailand made a proposal to the Japanese Government to undertake under the Colombo Plan a joint project for the development of the Taru Tau Island near the west coast of Thailand as

a fishing port for the benefit of both countries.

The Japanese Government decided to accept the proposal in view of the fact that the development project would not only produce economic benefits to the two nations but also contribute to a great deal to the existing friendly relations between Japan and Thailand.

In February and March of 1957 the two Governments made a preliminary survey of of the Island. Japan dispatched a research group headed by Mr. T. Iiyama, Vice-president of the Overseas Fisheries Co-operation Society, aboard the *Shoyo Maru*, research boat of the Fisheries Agency. The research group included eight experts on fisheries, fishing port, refrigeration and forestry, in addition to an official of the Ministry of Foreign Affairs.

The field survey which lasted for 33 days has proved that the development project of the Island as a fishing port would be technically feasible, subject to more detailed investigation and further negotiations between the two countries as to the requirements of the facilities.

KOREA

UNKRA Builds Fish Canneries

Korea will soon have two fish canneries each with a production capacity of 100,000 cases of canned food a year.

The canneries, one to be situated at Pohang on the east coast and the other at Narodo on an island off the south coast of Korea, will be built and equipped by United Nations Korean Reconstruction Agency (UNKRA) at a cost of US $ 324,500. The prefabricated building sections, two sets of cannery machinery, a small fish meal plant and two ice plants have already arrived.

According to estimates, the canneries were to be ready to go into operation in November 1957. Their main products will be canned mackerel, crab and shrimp.

This is part of an overall programme of aid for the fisheries industry being carried through by UNKRA under which fish-markets have been repaired, ice plants equipped, essential supplies for fishermen imported and new fishing boats and trawlers built (*UNKRA Newsletter*, I (17): 4, July 1957).

MALAYA

Fish Production

The total landings for the quarter July-September 1957 are comparable to those for the same period of 1956. Very poor landings in the North East Zone, were compensated for by the improved catches in the South East Zone, particularly in September. The improvement is attributed to increased use of 'pukat jerut' (purse-seine) units which can be used in more varied conditions than can traditional gear such as the 'pukat tarek' (beach-seine) and the 'pukat tangkol' (lift-net). Another factor contributing to the improvement is the increase in the number of diesel-powered craft operating 'bubu' (portable trap) in waters well offshore.

There have been unusually large numbers of immature 'selar kuning' *(Selaroides leptolepis)* and 'selayang' *(Decapterus russellii)* in the waters off the Pahang Coast, so much so that some lift-net operators refused to fish because the fish were too small and in such numbers that, if a shoal were netted, the strain might prove too much for the net. Very heavy catches of mature fish are anticipated before the onset of the North East Monsoon. On the West Coast bad weather has restricted the activities of many fishermen and has affected the catches of all types of gear.

Freshwater Fisheries

Six Junior Fisheries Assistants (Freshwater) have been posted to regions since July; one to Trengganu, one to Kelantan, two to Pahang, one to Malacca and one to Negri Sembilan. They have been carrying out preliminary surveys in their respective areas while being also available for on-the-spot advice to fish culturists. The benefit of this arrangement has become evident by an increase in the number of requests received by these Assistants for advice on the improvement of ponds, supply of *Tilapia* and carp fry, examination of sites for new ponds and other long-standing problems of successful rearing of fish.

Freshwater Assistants from Penang have been accompanying Mobile Cinema units of the Information Department in Kedah and North Perak on tours of villages. They have given talks on pond culture of fish and have met and discussed with interested villagers, the establishment of ponds in various areas.

Tilapia has established itself in Chin Chin Lake and in a mining pool at Kuala Sungei Bahru while the Tebat Gedang at Sri Menanti supports a heavy stock of *Tilapia* which has bred several times. In the Kubang Pasu and Kubang Haji Irrigation Canals 'Sepat Siam' (*Trichogaster pectoralis*) appear to have established themselves following stocking by the Department, but *Tilapia* has not proved so successful. A further release of *Tilapia* has been made. In addition to the above, 1,000 *Tilapia* and 4,420 'Sepat Siam' were released into the Sungei Muda River Irrigation Canal at Kapala Batas and 1,600 into Paya Bunga, Pahang. The Sungei Raya Irrigation Scheme in Negri Sembilan has been stocked with 'Sepat Siam'.

A noteworthy event was the successful breeding of 'Ikan Lampan Jawa' (*Puntius javanicus*) at the Federal Fish Breeding Station, Tapah, in August 1957. This is the first instance of breeding of this fish in Malaya and opens up a new avenue of development in pond fish culture.

Successful experiments were also carried out on the use of artificial nests in order to encourage the spawning of 'Kului' (*Osphronemus goramy*).

Mechanization

The rate of mechanization of fishing vessels has progressively increased. The most remarkable figures are for Kuala Trengganu where, during July–September 1957, a further 59 inboard engines were installed in fishing craft. In the South East Zone 9 new diesel engines were obtained with the aid of Rural and Industrial Development Agency (R.I.D.A.) loans. A further 5 new vessels of the Malacca driftnet fleet were completed, each fitted with a diesel engine. Of the total of 200 craft in the Malacca driftnet fleet, 109 vessels are now fitted with engines. In the North West Zone outboard engines are still being introduced and of a total of 36 vessels which have been fitted with engines since June this year, 32

are outboard engines and only 4 inboard diesel engines.

Experimental Fishing

Experimental 'bubu' (portable trap) fishing was continued from Kuantan and useful results were obtained. The echo-sounder survey work and the experimental fishing to determine and to solve problems in operation of 'bubu' fishing have been completed and a start has been made in the final phase in the programme which consists of comparative experiments using lines, baits and lights, and modifications to the traps.

Cockle (*Anadra granosa*) Culture

The possibilities of establishing cockle beds in new areas are being investigated and seed cockles have been experimentally planted in Johore and Pahang areas. Possible local sources for seed cockles on the East Coast are being investigated and trial sowings have been carried out using the local species which differ from that which is being used on the West Coast. At Kuah, Langkawi, where a trial plot was laid, the cockles disappeared without trace, probably due to their movement to a more suitable area, as empty shells would have been found if they had died from natural causes or if fish had been feeding on them. At Kuantan an experimental plot was found to have been destroyed, presumably by rays, etc., as the empty shells were found, in many cases crushed and broken.

Research is being carried out at Headquarters into the effects of reduction in population density of cockles in a given area, on the growth rates under different conditions and on the tolerance of the cockles to reduced salinity of the water in which they live. The determination of the spawning period and the sources from which natural beds are stocked is being attempted.

Dolphin Meal

Trials on the use of dolphin meal are still in progress, and a further 7 dolphins were processed in August to produce meal by a simpler and more effective method than had previously been used. This method gave a higher yield while the quality remained unaffected. The possible use for the oil extracted from the meat during the processing is being investigated.

Kelantan Fish Marketing Scheme

A total of 46,284 catties (catty = 1.33 lb.) of fresh fish was purchased during the quarter July-September 1957, for which a total of St. $ 7,187.55 was paid to fishermen and marketed at a gross profit of St. $ 597.87. The steady progress of the Scheme is being maintained in spite of the poor landings made by Kelantan fishermen, as is normal during the middle of the year. The three vessels run by the Scheme for towing fishing boats to and from fishing grounds earned St. $ 1,101.00 during the period under review. A rather unusual demand was made on the Scheme when one of its boats was called upon to help in the rescue of seven Indonesian fishermen who had drifted in their boat from Indonesia into Kelantan waters. Two of the starving men were taken ashore and cared for by the officers of the Fish Marketing Scheme at Bachok.

Fishermen's Training Course

A further course for 20 fishermen was started on 9 September and is still in progress. The facilities for the course are being extended by the acquisition of additional engines for demonstration and practical work and, in addition to one new engine of

a very popular make supplied free by the agents for the engine, arrangements have been made to obtain a further three old engines.

Course on Legal and Court Procedure

A group of Fisheries Assistants from various zones were given a week's course in legal procedure and processes involved in the initiation and prosecution of persons charged with offences particularly under Fisheries Enactments. The course included lectures, films and visits to courts.

Fishermen's Co-operatives

A major step in the progress of co-operative societies on the East Coast was taken on 5 July when the East Coast Fishermen's Co-operative Marketing and Transport Union was formed. The Union will eventually undertake transport and marketing of all fish landed by the various Fishermen's Co-operatives along the East Coast. The formation of the Union has already benefitted the existing co-operative societies in Trengganu as special discounts on the price of new engines and spare parts are already being offered to fishermen through the Union, and improved sales and maintenance services are being offered by agents for various makes of marine diesel engines.

Following a survey by the Deputy Manager of the Kelantan Fish Marketing Scheme, a Pilot Scheme has been prepared in order to expand the activities of the Beserah Fishermen's Co-operative Society, Pahang. The intention is that fish from Beserah should be marketed by the Society in the inland towns of Pahang which can absorb supplies of fresh sea fish in addition to those which they receive through Kuala Lumpur dealers. The value of such a Pilot Scheme has already been demonstrated by discovering, during final investigations prior to operation, practical difficulties which would not come to light in normal marketing investigations.

The Hengwa (Chinese) Fishermen's Co-operative Credit and Marketing Society at Malacca since its formation in 1956 has, with the help of the Fisheries and Co-operative Officers, obtained preferential rates for supply of fuel and engines and has also been able to discover sources of supply and manufacture of fishing materials. These measures have already resulted in savings to the fishermen.

PAKISTAN

General Notes

An exploratory fishing vessel with an overall length of 73′-6″, breadth 19′-7″, draught 11′, is being constructed. Final specifications of the vessel have been drawn up; construction may take one more year to complete. The vessel will be operated by the Central Fisheries Department's branch in Chittagong to survey the fisheries resources of the Bay of Bengal. The scheme for this exploratory survey at an estimated cost of Rs. 1,560,224 spread over three years was sanctioned in 1956. Pending the availability of this vessel, arrangements are in progress to procure a vessel from Japan. It is proposed that the Japanese vessel will conduct a preliminary survey. The detailed explorations with the vessel under construction will be planned according to the findings of the preliminary survey.

Construction of the fish harbour at Karachi has been continuing according to schedule.

Driving of piles has been completed; dredging of channels is continuing and 35% of the work near the basin turning has been completed. All the roads have been laid; their carpeting is due to be completed shortly. Among the buildings, the fishermen's restaurant is completed. Slabs have been laid in the fish market building. The construction of the co-operative store is due to be resumed shortly. Tenders for construction of the marine research building have been invited.

Implementation of the scheme for the development of fisheries on Mekran coast has been progressing according to schedule. Orders for fishing equipment worth Rs. 167,000 are shortly to be placed. The survey work in connection with the supply of water to Pasni has been completed. Blue prints of the pipeline have already been prepared. Detailed estimates for an ice plant and cold storage building at Pasni have been prepared. Construction of a Rs. 60,000 Fisheries Department office building at Pasni is to start soon.

Procurement of Fishing Requirements

A purchase mission consisting of three Directors of the Karachi Fishermen's Co-operative Purchase & Sale Society Ltd. and one representative of the Ministry of Agriculture, Government of Pakistan, visited Burma, Thailand, Hong Kong and Japan during Novembr 1957 in order to make direct purchases of nylon twine and teak wood for fisheries industry. The Government of Pakistan issued import licences to this Society to the value of Rs. 550,000.

Training in Fish Marketing

Mr. S.A. Jaleel, Assistant Director (Socio-economics), Central Fisheries Department, Karachi, left for Hong Kong about mid-October leading a party of 4 officials of the Department on a 6-month study tour. These 4 officials are: *Mr. Ehsan Ahmad, Syed Ahmed Kabir, Mr. Moulood Hasan Khan* and *Syed Abid Husain Zaidi*. They will study fish marketing under the supervision of the Hong Kong Fish Marketing Organization in order to be better fitted for their duties in the government supervised fish market to be located at the Karachi Fish Harbour now under construction. Details of their training will be worked out by the Hong Kong Fish Marketing Organization in co-operation with the leader of the party.

On their way back to Pakistan the 4 officials will spend 20 days in Bangkok and 10 days in Colombo studying the markets in these places for dried fish from Pakistan.

After 2 months in Hong Kong, Mr. Jaleel will leave for Sydney where he will attend the FAO/IPFC Training Centre in Fishery Co-operatives and Administration. On his way back to Pakistan, Mr. Jaleel will also visit Singapore, Vietnam, Bangkok, Rangoon and Colombo.

During his tour, Mr. Jaleel will study the markets in the countries visited for Pakistan's dried fish. On his return, he hopes to establish standards for cured fish and assist the industry to produce better products and find better markets for them.

PHILIPPINES

Marine Fisheries Research

The programme of marine research and training in marine research, developed as a result of the activities of Dr. K.F.W. Tiews, FAO/ETAP Marine Biologist (*Current Affairs Bulletin*, No. **19**: 22, July 1957) has been strengthened by provision of additional funds. The Philippine National Research

Council granted Pesos 3,000 for the procurement of some of the much needed equipment and supplies. The U.N. Technical Assistance Board granted Pesos 76,000 from out of its 1957-58 allocations. The programme received a further boost by a grant of Pesos 15,500 from the National Science Board for the continuation of the activities under this programme during a possible extension of Dr. Tiews' services for a second term.

Fish Canning Industry

The ground work for a canning industry has been laid in Dipolog, Zamboanga del Norte Province. At the present stage the industry is only on a cottage level. On account of the lack of capital with which to buy machinery and needed materials, as well as to expand the operation, the canners are only able to bottle their products. The products are reported to be much in demand because of the quality which is comparable to the best from abroad. The pioneers in these efforts are Spaniards who left their home country during the civil war and settled in the Biscay region of the Philippines.

THAILAND

Fish Production on the Increase

Fish production in Thailand rose by 112,000 metric tons during the period 1950-1955, an increase of 31%. This was stated by Mr. M.J. Lobell, Fisheries Specialist assigned to the United States Operations Mission (USOM) to Thailand, reporting on the USOM Thai-American Fisheries Project.

Based on the published figures and estimates, the total take from fisheries in 1955 (the most recent year for which data are available*) was 470,000 metric tons. This was made up of 151,000 metric tons of marine fish and 62,000 metric tons of freshwater fish, calculated as commercial catch, and 257,000 estimated as subsistence catch. The data for 1950 showed a total take of 358,000 metric tons: 116,000 from marine sources and 42,000 from freshwater, added to an estimated 200,000 metric tons for subsistence purposes.

Calculated on prices at wholesale markets, the value of the total catch in 1955 was Bahts 2,187 million (1 Baht = US $ 0.05). The value for the commercial catch in 1950 was about Bahts 556 million, as against Bahts 976 million in 1955.

By 1957 total production had increased at least 35 percent, fishermen were earning much more through the use of better methods and gear, and consumers were being provided with more and better fisheries products.

These improvements in the fisheries are, according to the report, a direct result of the activities of the Thai Department of Fisheries, the fishing industry and the assistance rendered to the industry by USOM as well as the Food and Agriculture Organization of the United Nations.

The report by Mr. Lobell quoted above sums up six years of operation of the Thai-

*According to *Yearbook of Fisheries Statistics*, 1955-56, Vol. VI, just published by the Food and Agriculture Organization of the United Nations, the commercial catch of both freshwater and marine fish in Thailand in 1956 was 217.9 thousand metric tons. This represents an increase of over 37.9% on the commercial catch in 1950.—Ed.

American Fisheries Project. The Project commenced in 1951 and the American assistance was phased out in mid-1957. This project was carried out as a series of specific, interrelated, and practical sub-projects designed fundamentally to provide in-service training for personnel of the Department of Fisheries. In executing the sub-projects, the logical pattern followed was: Definition of the problem to be solved, work plan of activities designed to give the information needed, actual testing through pilot operations accompanied by in-service training, evaluation of results, and finally presentation of the new ideas or techniques to the industry.

Quality of Fresh Fish

The Technology Section of the Department of Fisheries has for some time been studying the methods of handling and transportation of fish by boat and the quality of fresh fish landed at the Bangkok Wholesale Fish Market. About 40,000 tons of fresh fish are sold annually at this Market. *Rastrelliger* (pla thu) makes up about two thirds of this quantity, the remaining third being a large variety of fishes. Most of this fish is brought from the fishing grounds by boat; however, considerable quantities are also carried by truck, while transportation by rail is less important.

The fish is always mixed with ice, and ordinarily stored in bulk, 1.4 to 2.0 m. deep, in insulated fish holds. Fish of prize quality such as pomfret, bhekti and *Polynemus* are handled with more care; liberal amounts of ice are used, and bulk storage is avoided.

The cheaper 'pla thu' very often arrives in conditions that leave much to be desired; soft and burst bellies were most commonly observed.

Fish iced soon after capture and landed within one day was in relatively good condition; after the first day blood and excreta were squeezed out, thus accelerating spoilage. Fish of prize quality landed in good condition even after 10 days of being in ice.

Factors responsible for the poor quality of landed fish, particularly 'pla thu' are considered to be: insufficient amounts of ice used, improper mixing of ice and fish, and bulk storage.

Shrimp and Fish Paste

The Technology Section of the Department of Fisheries recently studied the methods of production, quality, composition and price of shrimp paste, 'kapi'. Shrimp and fish pastes are popular and commonly used food ingredients in Thailand.

Small shrimp *(Acetes)* is the most suitable raw material, but because of its shortage different fishes are mixed in varying quantities. The anchovies (pla katak) are preferred for this purpose, but other fish such as, *Rastrelliger* (pla thu) are also used occasionally.

The production of 'kapi' is typically a home industry and the processing method shows many variations from place to place. A common method for producing 'kapi' which was also tested in the laboratory of the Technology Section, consists of the following steps: *Acetes* is well mixed with salt in proportions of 4:1 by weight, the mixture is allowed to drain overnight, the brine is collected and boiled to coagulate the dissolved proteins. The coagulated protein is skimmed off for subsequent use in blending. The concentrated brine is evaporated in the sun to produce fish sauce (nam pla). The salted *Acetes* is dried in the sun until no liquid can be squeezed out

by hand pressure, ground two or three times in a meat mincer and finally stored for ripening in air-free containers.

In large scale experiments in the Technology Section the yield per 100 kg. was 52.5 kg. of 'kapi' (41% moisture and 23% salt), 18 kg. of 'nam pla' (12.5 g. N/litre), and 2.2 kg. of protein coagulate (63% moisture and 2.90% N).

The samples of 'kapi' collected from the market showed wide variations in appearance, flavour, composition and price. Some of the samples in the market were artificially coloured. Moisture content varied from 32 to 50% with an average of 41%; salt varied from 18 to 53% with an average of 26%; ash from 22 to 44% with an average of 29%; total N from 2.7 to 4.2% with an average of 3.4%, and volatile N from 0.13 to 0.36% with an average of 0.24%. The price varied from 3 to 25 Bahts per kg.

Fish Meal for Human Consumption

Experiments are currently in progress in the village of Nongkhorn in Ubol Province to ascertain if good quality fish meal would be acceptable for human consumption. The reasons for trying fish meal instead of fish flour are: 1) the inability of this particularly protein-hungry section of the Thai population to afford the rather costly fish flour, and 2) fisheries products such as shrimp paste and fish sauce which, according to western standard have a disagreeable odour, are already a popular item in the Thai diet.

The project is sponsored by the Ministry of Public Health in co-operation with the Department of Fisheries. The experiment is being carried out by trainees of the Thailand-UNESCO Fundamental Education Project, under the supervision of the Nutrition Officers of FAO Far East Regional Office.

Members of a hundred and fifty families are receiving a daily ration of fifteen grams of fish meal per head to supplement their usually meagre intake of protein. The people receiving the fish meal are being given instructions in its use; simple recipes, supplied by the Ministry of Public Health, tell of new curries, fish pastes and vegetable dishes.

The fish meal used in the experiment is of a reasonably good quality, produced locally from 'pla thu' (*Rastrelliger* Sp.) and some slipmouth at a fully mechanized modern fish meal plant at Chumporn, nearly 450 miles from Bangkok. The plant has a capacity of five tons of fish meal a day and can make the meal available at a retail price of four Bahts per kilogram.

The results of the experiments will not be known for some time.

UNITED KINGDOM

HONG KONG

Freshwater Fisheries

Some 1,800 piculs (1 picul = 133 lb.) of locally reared pond fish were harvested during the quarter, July-September 1957, as against approximately 2,400 piculs during the immediately preceding quarter. Prices remained roughly the same.

Hong Kong fish fry dealers exported a total of 5,905,265 fry, in 32 shipments, of the four main species of Chinese carps. These were

sent, by air and by sea, to Bangkok, Singapore, Saigon and Taiwan.

Marine Fish Landings and Prices

As compared with the corresponding quarter in 1956, market records for July-September 1957 showed an increase of 3.4% in fresh fish landings (from 140,970 to 145,761 piculs) and a decrease of 29.9% in salted dried fish (from 23,306 to 16,557 piculs).

The overall average wholesale prices for both fresh and salted dried fish were very nearly the same as during the previous year.

Fishing Craft

A total of 247 fishing boats, 152 of which were new boats, were mechanized during July–September 1957. These were mostly purse seiners, small longliners and trawlers. All but 31 of these new boats were constructed in the Colony. The total value of these new hulls alone (i.e., excluding machinery and rigging etc.) amounted to HK $1,193,700.

Five Government loans of from $5,000–$9,000 each were made during the quarter for mechanization of fishing craft.

The Craft Technician of the Fisheries Division designed a steam chest, for bending timber, and one of the leading junk builders has volunteered to use it. Price quotations for the construction of this chest were being obtained at the end of the quarter.

Fishery Research Vessel

In the case of the Fisheries Division vessel No. 2, it was decided that the hull planking, particularly the garboard strakes, should fit straight into the keel in accordance with local practice. This made for sharp corners which created partial vacuums and thereby upset the flow of water along the ship's side. To demonstrate the effect of a better shaped hull, the surveyors of the Marine Department kindly provided details of two tapered wooden fillets, which they suggested should be fitted on either side of the keel, to properly "fair" the lines of the boat. These fillets were duly made and fitted. In addition, the square edges of the stern chock were also rounded off, this being an elementary but important matter which, as yet, is not normally being done in the native junk building yards. Carefully conducted speed trials, both before and after the alterations, were carried out. The savings in fuel consumption varied between 12.3% at the maximum of 925 r.p.m. and 24.1% at the slower (trawling) speed of 390 r.p.m.

Fishing Methods and Gear

The Japanese fishing boat that had been operating a form of Danish seine net off the East coast of Hainan, and landing fish in Hong Kong, discontinued fishing. The vessel is undergoing repairs.

The proto-type motor car "back axle" fishing winch was being assembled on board Fisheries Division Vessel No. 2 *(Yuen Ling)* at the end of the quarter, July-September 1957.

The Assistant Fisheries Officer (Marine) was sent to Japan to undergo a 3-month's course of instruction, mainly concerned with fishing methods and gear, that had been especially arranged for him through the courtesy of the Japanese Government.

Certificates of Hong Kong Origin

Products certified by the Fisheries Division for export to the U.S.A. and Great Britain totalled:

(a) 28,263 catties (1 catty = 1.33 lb.) of fresh "Spotted Fish" (i.e., the brackishwater walking goby) for canning;

(b) 17,472.5 catties of silver shrimp for conversion into shrimp sauce and paste; and

(c) 6,414.5 catties of large fresh shrimp for conversion into shrimp slices and noodles.

(d) 3,902.5 catties of dried oyster and 9,111 catties of oyster juice. These quantities of dried meat and juice were obtained from 170,715.5 catties of fresh oyster meat harvested from Deep Bay bed adjoining British Territory.

Training of Fishermen

During the quarter, July-September 1957, the 7th Skipper class continued its instructions at the Aberdeen Fisheries Office.

During the same quarter twenty fishermen, trained by the Division, obtained certificates as Engineers while forty-two fishermen trained by the Division at Aberdeen, Cheung Chau, Taipo and Sai Kung, obtained Marine Department certificates of competency as coxswains.

SINGAPORE

Conversion of Swamps into Prawn Ponds

An experiment was started in 1954 to convert swamps into prawn ponds so that otherwise useless areas could be used for food production. Bunds were built to enclose 14 acres of swamp lying along the South Coast of Singapore. Wooden sluice gates were built to permit the flow of the tide and to enable prawns leaving the ponds to be caught whenever it is desired to do so.

The experiments have proved to be successful. The following results were obtained:

Period	*Catch in Catties* (1.33 lb.)				*Auction Price*
	Fish	*Crabs*	*Prawns*	*Total*	(St. $)
1954 (Oct.-Dec.)	–	–	1,035	1,035	1,873.12
1955	2,184	137	6,292	8,613	8,194.66
1956	1,598	100	6,676	8,374	9,376.81
1957 (Jan.-Sept.)	708	119	5,455	6,282	7,210.88

The average yield works out to 0.34 ton per acre per annum and the average gross income per annum is about $8,885 (Malayan Currency).

In order to increase further the income of the prawn pond operators, an experiment has been started to combine pig rearing with prawn pond operation. The initial results are encouraging.

UNITED STATES OF AMERICA

HAWAII

Equatorial Tuna

The Pacific Oceanic Fishery Investigations (POFI) U.S. Fish and Wildlife Service, have drawn some interesting preliminary conclusions from the current processing and preparation of the oceanographic

and biological data from the Marquesan area. Total sightings of tuna school and bird flocks were significally higher during January-February (104 and 97) than during September (42). A similar difference was evident in longline catches, with a catch rate of 6.0 tuna per 100 hooks during the Marquesan summer and 0.3 during the winter.

The mean catch rate of a Japanese longliner, *Schichiyo Maru* which was fishing 120 miles to the west of the Marquesas, at the same time as the POFI vessel was longline fishing near the Marquesas during the summer cruises, were 6.7 tuna per 100 hooks.

The contents of a total of 138 skipjack stomachs collected in the immediate vicinity of the Marquesas during the summer have been examind. These analyses yielded the following frequency of occurrence of the major groups of organisms:

44.5% Fish. With the exception of a few juvenile skipjack and *Auxis*, all were reef forms.
39.0% Crustaceans. Mostly stomtopods.
14.0% Molluscs. Mostly squid.
2.5% Tunicates.

It appears that these skipjack were largely dependent for food on organisms associated with the islands.

One index of productivity measured during the summer cruise was zooplankton. Surface and 0-60 and 0-200 metre oblique tows were taken at each station. At all stations along the Equator, and those down 145°W., the volumes from the 0-60 metre tows were greater than those from the surface tows. Along 130°W., however, the surface volumes were greater. Among all stations, the 0-200 metre tows showed comparatively little variation in volumes.

Examination of samples from the Equator and along 150°W. indicated that the higher volumes for the 0-60 metre tows were due to the larger size of Euphausiids and that the higher volumes for the surface samples along 130°W. were due to the greater number and size of the Siphonophores.

Skipjack Studies

Skipjack tagging was the most active of all projects, with 2,415 skipjack tagged and released off Cape Kaea, Lanai, during July and August. By the end of September, 273 of these had been recovered for a rate of 11.3 percent. The majority were recovered near Cape Kaea, but a few had moved as far as Kaena Pt., Oahu, to the northwest, and off Hilo, Hawaii, to the southeast.

During the first week in September a commercial sampan was chartered to do tagging work. This charter resulted in the release of 3,224 skipjack near Hilo, Hawaii. The charter was successful both from the number of fish released and the cost of 98 cents per tagged fish released. By the end of September, 162 or 5 percent of these tags had been recovered. All recoveries were within the area in which fish were released.

Also during the quarter, 17 of the skip ack tagged during the preceding quarter were recovered. Fish from one group released near Oahu were recovered at the extremes of the fishery, i.e. west of Kauai and off Hilo, Hawaii. The maximum distance between points of release and recovery was 185 miles.

A study of a skipjack concourse, an area in which skipjack regularly occur, was initiated off Lanai. The concourse is close to shore and thus may not be representative of oceanic conditions. However, analysis of the factors involved in this relatively stable

situation should furnish with the insight needed to plan an investigation of the more ephemeral oceanic microdistribution of skipjack.

At this writing the concourse has been defined, preliminary field observations on the environment are completed, and about 2,400 skipjack have been tagged in the concourse in order to ascertain the stability of the population. Thus far, 201 of these have been recovered in the concourse and 68 recovered away from the concourse. These statistics point to a semi-transient population attracted to the concourse for reasons as yet unknown.

Albacore Studies

The Northeastern Pacific Albacore Survey (NEPAS) was completed during July and August, and a biologist was sent to American Samoa during August to institute an albacore gonad sampling programme at the cannery at Pago Pago.

NEPAS differed considerably from previous albacore cruises in that it represented a transition from the broad study of general distribution and abundance to the more detailed problems of microdistribution and ecology and the beginning of field studies of behaviour. A different survey method was also used. Instead of using a single Service vessel to fish and do the related oceanographic and biological studies, seven commercial vessels were utilized to conduct a quasi-synoptic trolling survey while two Service vessels were making detailed studies of the microdistribution of albacore and biological and oceanographic conditions. The area studied was also different from those of previous surveys. Instead of exploring for new grounds or studying the conditions in a well established fishery, the survey was conducted in the 350-mile band off the coast of Washington, Oregon, and Northern California, where both the oceanographic conditions and the abundance of fish are known to have large annual fluctuations, making it an excellent area for studying the relations of the two.

The preliminary analysis of the fishing and oceanographic data indicates that albacore were scattered throughout the area, with the concentrations of commercial value concentrated in the warm side of the band of upwelling along the coast. The largest of these concentrations were in cells or tongues of warm water which extended shoreward between cells of cold upwelled water.

Attempts were made to hold albacore in the bait tanks of the *John R. Manning;* the longest survival period was 14 hours. Gross dissections of the pineal eye region were made. This structure was found to be extremely well developed, and its role in the behaviour of the albacore will be given further study.

The gonad collection programme in American Samoa was instituted as part of the albacore spawning studies. Longline-caught albacore from all parts of the western equatorial Pacific are delivered throughout the year to the Van Camp Company's cannery in Pago Pago. Arrangements were made to obtain seven pairs of gonads from each vessel landing. Cannery personnel will weigh and measure the fish and collect the gonads, which will be frozen and shipped to POFI for study.

Plankton work has consisted of detailed counts and sketches of gastropod and pelecypod larvae from plankton samples taken on cruise 25 of the *Hugh M. Smith.* The purpose was to determine whether there was a gradient in numbers from the Hawaiian Islands outward (to the north, northwest, and northeast) which would

indicate that these organisms had originated in the shallow waters around the Islands. Although the largest numbers were foundnear the Islands, no gradients could be detected. The three genera of gastropods found in the plankton were identified by comparing them with juvenile specimens found in Hawaiian Islands beach rubble.

The recovery of another albacore tagged by a POFI vessel was reported during the quarter. The fish was released on 31 July 1956 at 44°31′ N., 175°55′ W. and was recovered on 23 July 1957 at 30°08′ N., 119°03′ W. Thus in its 357 days of freedom it travelled at least 2,755 miles, and its weight increased from about 16 lb. to 21 $\frac{3}{4}$ lb. This is the fifth recovery of fish tagged by POFI in the central and eastern North Pacific and is the second recovery off southern California. The other three were recovered by Japanese fishermen in the western North Pacific.

Sampling of Tuna Larvae

Considerable effort was focused on the problem of developing a method of sampling tuna larvae that would capture numbers of larvae large enough to be meaningful and at the same time serve as an index of the population of larvae per unit of sea surface. Surface tows at night give the most larvae per tow, but are not reliable as an index of abundance, apparently because of variations in vertical distribution from place to place. Two-hundred-metre tows overcome these problems and appear to largely overcome day-night variations. They have the shortcoming, however, that too few larvae are taken because the net fishes below the larvae during too great a fraction of the haul. At present POFI are settling on a 140-metre tow (in areas where the thermocline is at or above this depth), and through a series of duplicate tows, it is hoped, to solve the length of tow and statistical variability problems.

Tuna Behaviour Studies

Field work has been completed in POFI's study to determine if the fishability of a tuna school, as reflected by the catch, is in any way related to the natural food of the fish prior to the onset of chumming, and most of the stomachs collected have been analyzed. A typical catch curve for a school has a short ascending limb to a peak followed by a more or less portracted decline to the cessation of fishing. On the average, 37 percent of the catch is made prior to the peak, and the balance at and after the peak. The problem now is to guess which of the several quantitative measures of the history of a catch from a school are chiefly a function of behaviour as opposed to school size and compare these with the stomach samples.

Pre-peak attributes such as length of time to peak, number of passes to attract the school, etc., might well be almost completely a function of behaviour. None of these, however, show any relation to the total catch from the school. Pre-peak behaviour cannot be discounted, however, because the total catch from many (49.4 percent) schools is zero simply because they do not respond to the chum at all.

Of the measures that are correlated with the total catch, absolute height of peak (r=0.614) and length of fishing after the peak (r=0.868), the former seems likely to be a function of behaviour, while the latter may be in large part a function of school size. Even here, there is no evidence that schools are ever "fished out", so behaviour may dominate this measure too.

A new project aimed at assembling and codifying knowledge of tuna behaviour from literature and fishermen was begun, with field work confined to the Hawaiian Islands. There is very little material in the literature, possibly because fishery scientists regard recording items on fish behaviour as non-science, as opposed to students of, for example, birds, who assiduously note behaviour items and find a ready outlet for their records in journals.

Underwater observations of skipjack and skipjack bait were begun in a small way, with attention focused on methods. An underwater platform from which observations can be made at speeds up to 6 knots in moderate seas, has been procured. The next big hurdle is finding a good method of recording observations, and *a priori* movies seem to offer the most promise.

Some interesting observations were made during the operational trials. It was found, contrary to tradition, that the Hawaiian anchovy (nehu) do not swim to the vessel after being thrown in the water, thus bringing tuna to the stern where they are caught. Rather, they always react negatively. Occasionally a hotly pursued nehu is seen swimming to the vessel but turns away as soon as he avoids the predator. This finding was quite a surprise, for it has always been assumed that a positive response to the vessel was an essential attribute of tuna bait.

It now appears that nehu are a good bait because of their avoidance of the vessel and their agility. When thrown from the vessel, they sound obliquely away at high speed and scatter to some extent (observed). This enhances their chances of being encountered by skipjack. The skipjack home in on the nehu and work their way back to the source of the chum (observed). Now, the agility of the nehu becomes important in drawing the tuna within reach of the fishermen, for it is apparent that the skipjack can crop the chum most readily by attacking them during the few seconds' orientation period after they first strike the water, rather than after these speedy little fish have become oriented and scattered.

Tilapia present another story. POFI have observed that *Tilapia* of all sizes show a positive response to the vessel, yet they are completely successful as chum only for larger skipjack (over 12 lb.). Underwater observations suggest their response to the vessel is unimportant for it is weak and their ability to swim such they can reach the vessel only when it is dead in the water. When this species is used to chum small skipjack, they elicit a response similar to nehu, but the tuna do not come within reach of the fishermen, perhaps because small skipjack can capture all of the sluggish *Tilapia* without moving in close to take advantage of the "orientation period" immediately following the chum's striking the water.

This hypothesis is consistent with the differential success that is obtained when *Tilapia* are used as chum for small and large skipjack, for it is not unreasonable to suppose that the larger fish are less agile than the small ones and that they and it advantageous to move in close to the vessel, as do all sizes when the more agile nehu is used. One can recommend that commercial fishermen using *Tilapia* adopt the slowest possible vessel speed and when small skipjack are found either stop the vessel or abandon the school.

FAO ACTIVITIES

Training Centre in Fisheries Co-operatives and Administration

The FAO/IPFC Training Centre in Fisheries Co-operatives and Administration formally opens in Sydney on 16 December 1957. This Centre is sponsored jointly by the Government of Australia and the Food and Agriculture Organization of the United Nations in co-operation with the Indo-Pacific Fisheries Council and its Member Governments and with assistance from the Governments of Canada and Hong Kong. It will be conducted by the Commonwealth Fisheries Office (Department of Primary Industry) of Australia.

Mr. J.A. Tubb, Regional Fisheries Officer for Asia and the Far East and *ex-officio* Secretary of the Indo-Pacific Fisheries Council will represent both FAO and IPFC at the opening ceremony. Dr. D.B. Finn, Director of FAO Fisheries Division, will visit the Centre towards the last week of its duration.

The 25 participants selected for the Centre are:

BURMA

1. U Khin Maung,
   Assistant Registrar (Fishery),
   Co-operative Fishery Department,
   519 Merchant Street, Rangoon.

2. U Htay Than,
   Township Co-operative Officer (Fishery),
   Co-operative Fishery Department,
   519 Merchant Street, Rangoon.

CEYLON

1. Mr. S.S. Asirwatham,
   Assistant Commissioner,
   Departmenr of Co-operative Development,
   Vavuniya.

2. Mr. V.L.C. Pietersz,
   Assistant Director of Fisheries
   (Administration & Socio-economics),
   Department of Fisheries, Galle Face,
   Colombo.

HONG KONG

1. Mr. C.T. Large
   Assistant Registrar of Co-operatives,
   Co-operative and Marketing Department,
   Tung Kung Street, Yaumati, Kowloon.

2. Mr. W. Duncan,
   Assistant Marketing Officer,
   Co-operative and Marketing Department,
   Tung Kung Street, Yaumati, Kowloon.

INDIA

1. Shri M.T. Nathan,
   Manager-cum-Marketing Officer,
   Saurashtra Central Co-operatives,
   Fish and Fishery Products Marketing
   Association Ltd.,
   Veraval, Commercial Building,
   Veraval, Saurashtra.

2. Shri A. Panigrahi,
   Assistant Registrar of Co-operative-
   Societies-cum-
   Special Officer, (Fisheries),
   P.O. Phulbani, Orissa.

3. Shri D.A. Desai,
   Deputy Registrar, Co-operative Societies,
   592 Budhwar Peth, Poona, Bombay.

4. Shri V.P. Kale,
   Superintendent of Fisheries (Coast),
   Ratnagiri.

INDONESIA

1. Mr. Soekarno,
   Chief, Socio-Economics Division,
   c/o Djawatan Perikanan Darat
   (Inland Fisheries Service),
   2 Djalan Nusantara, Djakarta.

2. Mr. W.A. Abdullah,
   Fisheries Adviser,
   Djalan Pereatuan Guru No. 7, Djakarta.

JAPAN

1. Mr. T. Sakamoto,
   Fisheries Adviser,
   1613 Uchihamacho, Choshi City,
   Chiba Prefecture.

KOREA

1. Mr. Kim Tai Woo,
   Fisheries Technician,
   Fisheries Administration Section,
   Bureau of Fisheries, Office of
   Marine Affairs,
   Seoul.

MALAYA

1. Abdul Salam bin Haji Ibrahim,
   Kelantan Fish Marketing Scheme,
   Bachok, Kelantan.

2. Abdul Samad bin Haji Salleh,
   Senior Co-operative Marketing Officer,
   c/o Department of Co-operative
   Development,
   Kota Bharu, Kelantan.

PHILIPPINES

1. Mr. Justo R. Montemayor,
   Fishery Economist, Bureau of Fisheries,
   Department of Agriculture & Natural
   Resources,
   Ermita.

2. Mr. Porfirio R. Manacop,
   Chief, Fisheries and Salt Development
   Projects,
   Agricultural Credit & Co-operative
   Financing Administration,
   2544 Taft Avenue, Manila,

3. Mr. Jose Q. de la Cruz,
   Commercial Co-operative Officer,
   Bureau of Fisheries, Manila.

PAKISTAN

1. Mr. S.A. Jaleel,
   Marketing Officer,
   Central Fisheries Department,
   Karachi.

2. Mr. A.G. Hussain,
   Deputy Director,
   Central Fisheries Department,
   Karachi.

SINGAPORE

1. Inche Masdawood bin Ahdan,
   Fisheries Inspector,
   c/o Fisheries Division,
   Godown No. 3, Telok Ayer Basin.

THAILAND

1. Mr. Swasdi Thiemmedh,
   Chief, Administration Division,
   Department of Fisheries, Bangkok,

2. Mr. Sving Suwananonta,
   Assistant Fisheries Officer;
   Socio-economics Section,
   Department of Fisheries, Bangkok.

SOUTH PACIFIC COMMISSION

1. Mr. C.G. Joannides,
   Co-operative Officer,
   South Pacific Commission,
   Post Box No. 9, Noumea, New Caledonia.

Mr. C.G. Setter, Commonwealth Assistant Director of Fisheries, Australia, is Director of the Training Centre, and Mr. A.H. Mac Donald, Director of Fisheries in Saskatchewan, Canada, is FAO's Associate Director.

Other lecturers whose services are provided FAO are: Father K. O'Dwyer, S.J., of by Hong Kong; Mr. Alex Laidlaw, for many years Associate Director of the Extension Department of St. Francis Xavier University, Canada and at present Adviser on Co-operatives to the Indian Government.

In addition to Mr. Setter, other Australian lecturers will be: officers of the N.S.W. Registrar of Co-operative Societies; Mr. H. Harris, Sydney Fish Market Manager; Mr. J.L. Dibbs, Manager of Nowra Fishermen's Co-operatives who was also Chairman of the former Association of Fishermen's Co-operatives in New South Wales; Mr. R.M. Fowler, General Manager of S.A. Fishermen's Co-operative Ltd.

On his way to Sydney, Mr. MacDonald was briefed at FAO Headquarters in Rome. He also visited Pakistan, India, Ceylon, Singapore, Malaya and Indonesia to see as much as possible of any fisheries co-operatives which may be accessible locally, to consult the officials concerned with the promotion and management of such co-operatives and to meet any participants attending the Centre from these countries.

FAO supplied the following notes on the lecturers it is sending to the Centre:

Mr. A.H. MacDonald, Director of Fisheries, Saskatchewan, Canada. This 46-year old Canadian received training at the well-known Catholic University, St. Francis Xavier, Nova Scotia. He also studied sociology, adult education, and co-operatives at Columbia University, New York City, and co-operative business and store management at New York's Rochdale Institute. He has had 22 years of practical experience in fisheries work, especially in the field of co-operatives, in which he has been engaged in the promotion and organization of Fishermen's Co-operatives of all kinds. At one time he served as Secretary-Treasurer of the famous organization, United Maritime Fishermen, Halifax, Nova Scotia. Later, he became Director of Fisheries Saskatchewan where the practice of co-operation is strongly established in fisheries and in many other fields of work. In 1954-56 he was specially assigned to Ceylon by the Canadian Government under the Colombo Plan. He advised on fishery co-operatives and organized a programme to set up fishermen's co-operatives and to introduce Co-operative education among fishermen.

Father K. O'Dwyer, S.J., is a 45-year old Irishman and a graduate in mathematics of University College, Dublin. He was a lecturer at the FAO International Fish Marketing Training Centre at Hong Kong in 1954. Father O'Dwyer has been very actively associated since World War II with the organization and development of the Government-sponsored Hong Kong Fish Marketing Organization, and with the promotion of fishermen's co-operatives in that colony. He was a member of the Hong Kong Vegetable Marketing Board in 1953. Earlier, in 1949, he lectured on co-operatives in the Philippines. He has an exceptionally wide experience of fisheries co-operatives in the post-war period in the Far East.

Mr. Alex Laidlaw, a Canadian, has been for many years Associate Director of the Extension Department of St. Francis Xavier University. He has, of course, considerable experience of the promotion of co-operatives among fishermen in the maritime provinces

of Canada. At present he is serving under the Colombo Plan, as Adviser on Co-operatives to the Indian Government. He has been concerned with the entire system of co-operative education and credit under the aegis of the Agricultural Credit Department of the Reserve Bank of India. With the first hand experience gained in these activities, he has a wide knowledge of the special problems connected with fishermen's co-operatives in the Indo-Pacific region—the particular area with which the Training Centre is especially concerned. Mr. Laidlaw began his career as a school teacher, became secretary of a co-operative society in 1937 and from 1914-44 was Secretary of the Department of Education, Nova Scotia. He then joined the staff of St. Francis Xavier.

The Centre will be based in Sydney from 16 December to 12 January. The Sydney programme includes visits to the Sydney Fish Market, to Co-operatives handling agricultural products (there being no fiisher-men's co-operative in Sydney), and a one-day visit to Nowra Fishermen's Co-operative about 100 miles down the South Coast.

On 12 January the participants will travel to Adelaide by chartered T.A.A. Viscount. The Adelaide programme includes visits to the Fish Market, which is owned by S.A. Fishermen's Co-operative, an overnight trip in the Gulf m.v. *Minnipa* to Port Lincoln where next day participants will inspect the fish cannery, and a two-day, 160-mile trip by chartered bus to the famous fruit and wine co-operative centre of Renmark.

Matser Fisherman for Ceylon

Mr. E. Barlind (Sweden) arrived in Ceylon in Septmber 1957 on a 12-month assignment as FAO/ETAP Master Fisherman.

His terms of reference are "to advise and assist with the operation and maintenance of fishing vessels and the construction, operation and maintenance of important types of fishing gear, including drift nets and trawls, the improvement of the present fleet of Ceylon, and of fishing methods in the ocean waters contiguous to Ceylon, adapting locally available materials wherever possible and with special reference to small fishing craft and gear to be operated therefrom; and to teach groups of local fishermen how to operate small motorized craft, handle improved types of fishing gear, and construct and maintain fishing gear".

Mr. Barlind has had extensive experience both as mate and skipper on highline fishing boats in the North Sea, trawling for herring, purse-seine fishing, small boat longlining, lobster, crab, shrimp and eel fishing, and drift netting for mackerel. In addition, he is quite familiar with the maintenance and servicing of diesel and petrol engines, ranging from 10 to 300 h.p.

Dr. Hess on Assignment to India

At the request of the Government of India for a TA expert to advise on the establishment of a Central Government Fish Processing Research Laboratory, Dr. E. Hess. Chief of the Fisheries Technology Branch, FAO Fisheries Division, Rome, was due to arrive in India on 25 November 1957. During his assignment Dr. Hess will discuss with various Central and States Fisheries administrators and workers to assess the present research facilities, the research programmes and the activities carried out by the various States and the Central Government in the fields of fish handling, processing, storage, transport and distribution. Before leaving New Delhi for Rome on 20 December, Dr. Hess will have discussed the first draft

of his report with the Fisheries Adviser to the Government of India.

Meetings attended*

Mr. T. Laevastu and Mr. S.J. Holt of the Biology Branch, Fisheries Division, FAO, Rome, attended the 45th Statutory Meeting of the ICES in Bergen, 30 September to 8 October 1957. Mr. Holt presented a statement at this Meeting on behalf of FAO and IPFC which he also represented as an Observer. This statement outlined the close co-operation between ICES and FAO as examplified in the recent Symposium on the Measurement of Primary Production in the Sea held in Bergen and the Workshop on Population Dynamics and the Selectivity of Fishing Gear held in Lisbon. Mr. Holt also outlined the projects on which FAO is currently engaged and concerning which FAO has received help from ICES. He specially stressed the FAO programme in connection with the Methods and Data of Aquatic Resources Appraisal, FAO's collaboration with the Italian Delegation to the Permanent Commission for the Scientific Exploration of the Mediterranean in the preparation and publication of the *Bibliographia Oceanographica*, and FAO's interest in the standardization of fisheries statistics and improvements in compiling them.

Mr. Laevastu also participated in the Joint ICES/UNESCO Symposium on the Measurement of Primary Production in the Sea. This Symposium preceded the Statutory Meeting of the ICES by three days. Three papers presented by FAO Fisheries Division at the Symposium were:

1. Zooplankton considered in respect of its relation with phytoplankton and as a factor effecting basic production and fisheries;
2. Review of the methods used in plankton research and conversion tables for recording the data and recommendations for standardization;
3. The oceanographic conditions for the life and abundance of the phytoplankton in respect of fisheries.

These review papers by FAO were commended and their separate publication urged.

Dr. E. Hess, Mr. H. Kristjonsson, Dr. J. Scharfe and Mr. J.O. Traung attended the International Fishing Gear Congress, Hamburg, 7-12 October 1957. Mr. S.J. Holt, on his way back after attending the ICES Meeting in Bergen, also participated at the Congress. Among other papers presented by FAO at the Congress was a "Note on the relation between biological and technological studies and their place in Fisheries Science".

FAO was represented at the UNESCO IACOMS Second Session Bangkok, 15, 16 and 18 November 1957, by Mr. J.A. Tubb, FAO Regional Fisheries Officer for Asia and the Far East.

Among others, Mr. J.A. Tubb and Dr. M.R. Khan of the Fisheries Division, FAO Regional Office for Asia and the Far East, represented FAO at the 9th Pacific Science Congress and participated in the deliberations of the Divisions of Fisheries and Oceanography.

Mr. Tubb presented a paper entitled "Shifting Cultivation and Inland Fisheries" at the Symposium on "Effects of Shifting Cultivation on Natural Resources with Special Reference to Problems in South East Asia". On behalf of FAO Mr. Tubb

*For further news see under MEETINGS AND CONFERENCES.

also presented a paper entitled "FAO and Pacific Science" at the Symposium on "Contributions to Pacific Science by International Organizations".

Mr. L.P.D. Gertenbach and Mr. H. Rosa of the Biology Branch of FAO Fisheries Division, attended the Symposium on Oceanography and Sea Fisheries on the West African Coast, Luanda, 21-27 November 1957. The following papers were presented at the Symposium by FAO:

1. A note on the FAO programme in connection with living aquatic resources, with special refernce to the compilation of data on species of economic importance.
2. A synopsis of biological data on the species of *Trichiuroidei*.
3. Present status of knowledge of the living resources in the waters off the West Coast of Africa.
4. A brief introduction to FAO's work in the field of fisheries statistics of the countries in Africa South of the Sahara.

The "Synopsis of Biological Data on the Species of *Trichiuroidei*" was prepared as a part of the work done in the World Survey of the Living Aquatic Resources on which the Biology Branch of the Fisheries Division, FAO is engaged.

Similar synopses have been drafted on *Rastrelliger* and *Hilsa* for the Indo-Pacific Fisheries Council, and one on whales was submitted to the International Whaling Commisson. Other synopses are also planned.

Each synopsis is distributed first in draft form and biologists interested in the group of fishes to which each synopsis relates are requested to criticise and comment on the synopsis. These comments are considered for the final edition of the synopses. It is hoped that when each synopsis reaches definitive form it will be printed in loose-leaf format to permit of easy revision as new information is obtained from current researches.

Documents and Publications

During the period July–October 1957 the following publications and documents were issued by the FAO Fisheries Division:

FAO Fisheries Bulletin

Vol. X, No. 3 – English, French and Spanish

World Fisheries Abstracts

Vol. VIII, No. 4, 5 – English and French

Vol. VIII, No. 2–4 – Spanish

Yearbook of Fisheries Statistics, 1955–1956, Vol. VI

Fisheries Study

No. 5: *Government Services to the Sea Fish Industry of Great Britain*

No. 7: *Electrical Fishing*

The following publications are among those in preparation:

Technological Dictionary. The Curing Section of the Dictionary is ready for stencilling and the Gear Section for reviewing. Work is proceeding on the Refrigeration Section.

Fishing Boat Tank Tests. Work has recommenced on Part 2 of this publication.

An Annotated Bibliography on Fishing Gear and Methods. This Bibliography is complete and shortly to be distributed.

World List of Periodicals for Fisheries Science. The first draft of this publication was circulated for comments and criticism. The replies already received are being processed.

In addition, several technical papers were presented at various International Meetings' Conferences and Symposia. (See under FAO ACTIVITIES: Meetings Attended).

For the forthcoming U.N. Conference on the Law of the Sea, the following papers were presented as working documents:

1) The economic importance of the sea fisheries in different countries.

2) Examination of living resources associated with the sea-bed of the continental shelf, as defined in article 64 with regard to the nature and degree of their physical and biological association with such sea-bed.

3) Conditions of the life of the benthos in the sea and its quantitative evaluation in respect of fisheries.

I.P.F.C. AFFAIRS

Staff Movements

Mr. J.A. Tubb, FAO Regional Fisheries Officer for Asia and the Far East and *ex-officio* Secretary of the Indo-Pacific Fisheries Council, left Bangkok on 6 December 1957 for Australia on home leave. He is expected to return to Bangkok about mid-March.

Mr. Tubb will break his home leave between 15-22 December to represent FAO and IPFC at the forthcoming FAO/Indo-Pacific Fishery Co-operatives and Administration Training Centre opening at Sydney on 16 December 1957.

During Mr. Tubb's absence, Dr. M.R. Khan, Assistant Regional Fisheries Officer, will be in charge.

Meetings Attended *

Mr. S.J. Holt of FAO Fisheries Division represented IPFC as an Observer at the 45th Statutory Meeting of the International Council for the Exploration of the Sea (ICES) held in Bergen, 30 September to 8 October 1957.

Based on Mr. Holt's report on the Meeting an occasional paper is proposed to be published by the IPFC. This paper is under preparation.

Mr. J.A. Tubb represented IPFC at the UNESCO/IACOMS Second Session held in Bangkok, 15, 16 and 18 November 1957. Mr. Tubb also represented IPFC at the 9th Pacific Science Congress held in Bangkok, 18 November–9 December 1957.

Technical Committee Activities

In order to accelerate activities of the Technical Committees, the Technical Secretaries whose services have been provided by FAO, have introduced 'Newsletters' which

* For further news see under MEETINGS AND CONFERENCES, and FAO ACTIVITIES: Meeting Attended.

are to be issued periodically to the members of the committees and their panels. These letters report action taken by FAO and or the Council, transmit information furnished by Committee members as to action being taken by Member Governments. They also contain notes, as and when possible, on current research activities in other areas relating to subjects of interest to the Committees and their Panels. The first of this newsletters did not evolve appreciable response from the members of the Committees. Reminders have been issued.

Executive Committee Meeting

The next meeting of the Executive Committee is proposed to be held soon after Mr. Tubb returns from home leave. Date and place have not been decided yet.

Docouments and Publications

Printing of Section I of the IPFC 6th Proceedings was completed. Its distribution has been withheld pending printing of Sections II & III which is expected to be completed shortly.

The 7th Proceedings are currently being proof-read.

An Occasional Paper entitled "Fishery Programmes in Relation to Agricultural and Economic Planning" is planned to be published shortly. This paper is based on a contribution, "Fishery Programmes in Relation to Agricultural and Economic Planning", presented on behalf FAO by Mr. J.A. Tubb at the 3rd Meeting of the Joint ECAFE/FAO Working Party on Economic Development and Planning held in Bangkok, 16-28 September 1957.

Another Occasional Paper entitled "Shifting Cultivation and Fisheries" is planned to be published. This paper will be based on an article entitled "Shifting Cultivation and Inland Fisheries" presented by Mr. J.A. Tubb at the Symposium on "Effects of Shifting Cultivation on Natural Resources with Special Reference to Problems in South East Asia" held during the Ninth Pacific Science Congress, Bangkok, 18-30 November 1957.

A third Occasional Paper planned for publication will be based on the report of this Council's observer at 45th statutory Meeting of the ICES.

PERSONALIA

Dr. Albert L. Tester, formerly Director, Pacific Oceanic Fishery Investigations (POFI) of the U.S. Fish and Wildlife Service, was appointed in September 1957 Acting Chief, Division of Biological Research, Bureau of Commercial Fisheries, U.S.A. The appointment is to be made permanently as soon as necessary personnel action has been completed. Dr. Tester in his new position is stationed in Washington, D.C.

Dr. Tester has been very actively associated with the Indo-Pacific Fisheries Council for the past several years. At the 7th Session in Bandung, 13-27 May 1957 Dr. Tester took a very active part in the deliberations, particularly of Technical Committee I. Dr. Tester was nominated by his government as IPFC Administrative Correspondent for the period 1957-58. After he left for his new position, Mr. Garth I. Murphy, Acting Director of POFI, has been nominated as Acting IPFC Administrative Correspondent.

Dr. C. F. Hickling, Fisheries Advisor to the United Kingdom Colonial Office arrived in

November on a visit to the Fish Culture Research Station, Batu Berendam, Malacca. During his visit, extending over a few months, Dr. Hickling will attempt to correlate and re-organise the administration of this Staion in relation to changes arising as a result of the present independent status of the Federation of Malaya.

Dr. Maurice Blackburn, formerly in charge of sea fisheries investigations in the Australian C.S.I.R.O., and more recently Professor of Zoology at the University of Hawaii, is now leader of the new Saltonstall-Kennedy project in oceanography at the University of California, Scripps Institution of Oceanography, La Jolla, California. This project has been contracted to the Scripps Institution by the United States Fish and Wildlife Service, for physical and biological oceanographic studies of the portion of the eastern tropical Pacific in which the California high seas tuna fleet operates. The programme has been financed for three years and is intended to contribute to a better understanding of the distribution of yellowfin and skipjack tuna in relation to differences in their oceanic environment; the eventual aim is to forecast places and times at which fishing should be most profitable.

Mr. Claro Martin, Chief of the Fisheries Research Division, Philippine Bureau of Fisheries, was by a special order of the Secretary of Agriculture and Natural Resources, detailed to the Philippine National FAO Committee, effective 12 September 1957. Mr. Martin will concurrently perform the duties of his position with the Bureau of Fisheries and those of his new assignment. He wlll assist the Executive Secretary of the Committee and officiate during the latter's absence.

Mr. Santos B. Rasalan, Chief, Exploration Section. Marine Fisheries Division, Bureau of Fisheries, represented the Philippines at the last International Fishing Gear Congress at Hamburg, 7-12 October 1957. On his way back he was due to stop at Tokyo to attend to matters pertaining to the reparations request of the Philippine Bureau of Fisheries, particularly to ensure that the two boats requested are included in the bidding for the second year instalment. The much needed boats, one 250-tons, and another, 100-tons, are to be used for exploratory fishing and marine biological research respectively.

Mr. D. Pathansali, B.Sc. (Malaya) and B.Sc. Special (London), was appointed Fisheries Officer (Research), H.Q. Fisheries Department, Federation of Malaya and Singapore. **Mr. Khoo Tiang Lim,** B.Sc. Hons. (Melbourne) and **Mr. T. Ubaidillah** B.A. Hons. (Malaya) were appointed Fisheries Officer (Research), and Distribution and Marketing Officer respectively in the same Department.

Mr. Pathansali is working on the biology of Malayan cockles. Mr. Lim is engaged on the use of insecticides for ridding ponds and mining pools of predaceous fishes preparatory to restocking; and Mr. Ubaidillah is studying the problems of fish distribution and marketing on the East Coast of Malaya.

Mr. E.H. Dahlgren, Fisheries Expert, attached to ICA of the United States of America left Indonesia for USA on 23 November 1957. Mr. Dahlgren has been engaged during the last 4 years in advising the Government of Indonesia on the developments of the living aquatic resources of the country.

CURRENT READING

The *Galathea* Deep Sea Expedition, Described by members of the expedition and edited by A.Fr. Bruun, S. Greve, H. Mielche and R. Sparck. Translated from the Danish by R. Spink. George Allen and Unwin, London, 1957. 296 pp.; Price 40s.

The *Galathea* Expedition, which set sail from Copenhagen in 1950, was only the fourth major expedition which was equipped to explore all the great deeps of the oceans. In two years she circumnavigated the world. When she departed very few dredge hauls had been made below 6,000 m. and only one below 7,000 m. It was seriously disputed whether life existed in the abyssal depths below 10,000 m. When she returned she had fished over 100 specimens, representing six species and five phyla, from depths of over 10,000 m. and thousands more embracing all the major phyla, including vertebrates, from depths greater than any previously attempted. Living bacteria were brought up from the extreme depths, in mud samples, and cultured in the laboratory, where they would only grow under pressures of 1,000 atmospheres. Any account of this expedition is inevitably exciting to anyone interested in marine biology, and this account is made doubly so by the freshness imparted by description given by those who took part. A book of this nature is, of course, patchy, since the various writers have very differing styles and concepts of their readers' backgrounds, but even this adds variety. The translation is perhaps a trifle clumsy. The illustrations are more than adequate and make quite certain that this will take its place among the books of permanent value devoted to the great explorations of the world.

The Freezing Preservation of Foods, Vols. I and II, 3rd edition by Donald K. Tressler and Clifford F. Evers. Avi Publishing Company Inc., N. Compo Road, Westport, Conn., U.S.A. 1957. In English. Price: Vol. I (1236 pp, illus., tables) US$18; Vol. II (574 pp., illus., tables) US$10.

A completely revised and greatly augmented edition, in two volumes, of the 1947 publication.

Vol. I comprises 31 chapters. Besides considering such problems of general interest as freeze-drying, microbiology of frozen foods, transportation, marketing sanitation, quality control and standards, two chapters deal exclusively with fish—The Preparation and Freezing of Fish, and The Preparation and Freezing of Shellfish.

Vol. II is an entirely new book, complete in itself, and contains information on the production, marketing and use of frozen precooked foods and desserts, baked goods and confections. Two of the 24 chapters deal with Precooked Fish and Fish Dishes, and Prepared and Precooked Shellfish.

Prelimitary Report on Expedition *Eastropics* by Joseph E. King, Thomas S. Austin and Maxwell S. Doty, *Special Scientific Report—Fisheries* No. 201, *U.S. Fish and Wildlife Service, Washington, D.C.*

The *Eastropic* Expedition was a co-operative survey of the central and eastern tropical Pacific conducted during the period September-December 1955. Five research vessels took part in the survey, representing the Scripps Institution of Oceanography, the Inter-American Tropical Tuna Commission, the California Department of Fish and

Game, the Pacific Oceanic Fishery Investigations of the U.S. Fish and Wildlife Service, and the Peruvian Navy.

This report lists the results, without analysis, obtained during the cruise of the vessel *Hugh M. Smith*, which was made as P.O.F.I.'s contribution to the expedition. During the 86-day, 14,000 mile voyage, information was obtained on east-west gradients in temperature, salinity, phosphate, zooplankton and forage fish abundance along the northern boundary of the Equatorial Countercurrent and along the Quarter between 110 W. and 156 W. Longitudes.

The data are made available in this preliminary report for the joint benefit and use of all collaborating scientists and other agencies interested in the central and eastern Pacific. More definitive reports are to follow.

Differences in the Food of the Young and the Adult Indian Mackerel, *Rastrelliger kanagurta* (Cuv.), by K.V. Narayana Rao and K. Pampapathi Rao, *Nature*, **180** (4588): 711-712, 1957.

Analysis of data from 593 mackerels ranging from 32 to 243 mm. in total length collected from the Lawson's Bay landings near Waltair, India, examined over a period of more than a year, indicates that mackerel of 90 mm. and more in total length are plankton feeders, consuming large quantities of phytoplankton along with a small quantity of zooplankton. Though the proportions of the phyto- and zoo-planktonic elements in the stomach contents of this fish are more or less in accordance with their relative abundance of the plankton, a selective feeding (avoidance) exists at least with regard to such macroplanktonc forms such as medusae, ctenophores, salps and chaetognaths. In the stomach contents of mackerel of size-range, 90-243 mm. total length, relatively little zooplankton was found and this consisted of the following forms: copepods, larval cirripeds, larval pelecypods, *Lucifer*, *Evadne* and larval crustaceans.

The stomach contents of juvenile fish, 32-90 mm. total length, showed that fish larvae (*Anchoviella* species) form their staple food, and this is supplemented by the planktonic sergestid, *Lucifer*. In rare cases, copepods and few Protophyta were noted in the stomach contents.

The relative length of the digestive tract is greater in the adult fish than in the juveniles. The change in the food habits of the fish and the relative length of its alimentary canal takes place at the same total length of fish. It is very likely that this change in the relative length of the alimentary canal of the mackerel is associated with the change in the food habits of the fish at about 90 mm. total length.

Prawn and Prawn Fishery of East Pakistan, by N. Ahmad, Directorate of Fisheries, Government of East Pakistan, Dacca, 1957, ix + 31 pp., pls. IX.

Contains a systematic account and field key to 22 species of East Pakistan prawns. Includes information on the production, methods of fishing, price, preservation and curing of the prawn in East Pakistan. The bibliography lists 10 publications on these prawns. The 9 plates contain drawings of the heads of the 22 identified species and the various fishing gear employed in the capture of prawn in East Pakistan.

By-products: Silage from Fish Offal, by H. C. Freeman and P. L. Hoogland, *Canadian Fisherman*, **44** (4): 24, 1957.

Describes a simple process enabling fishermen to make silage from fish offal. The

silage can be sold to farmers for mixing with grain to feed to poultry and pigs.

The process was apparently first developed in Denmark and Norway, using sulphuric acid, hydrochloric acid, or lactic acid bacteria. It has been studied for more than a year by the Atlantic Fisheries Experimental Station of the Fisheries Research Board of Canada at Halifax, Nova Scotia.

Four to five gallons of water are poured into a 900-gallon cask, and 200-300 lb. of offal added, along with 5 lb. of sulphuric acid to each 100 lb. of offal. After two or three days, 200-300 lb. of offal and 5 lb. of sulphuric acid per 100 lb. of offal are added every two to four days until the cask is filled. The mixture is stirred once daily with wooden paddle until the offal is completely digested. This takes two to three weeks at room temperature and three to four weeks at 50°F. The silage is then stored in four 25-gallon wooden barrels. At room temperature it will keep for at least a year.

Before feeding to livestock, the acid silage must be neutralised. This is done by gradually adding and stirring in ground limestone or chalk in the proportion of 2.5 lb. for every 100 lb. of silage.

Neutralisation should be done in small batches as the neutralised product is very perishable and at room temperature will spoil in a few days.

Feeding to pigs should be discontinued two to three weeks before slaughter to avoid a fishy taste in the meat.

MEETINGS AND CONFERENCES*

International Fishing Gear Congress

The first FAO International Fishing Gear Congress, which took place in Hamburg, Federal Republic of Germany, from 7-12 October 1957, was attended by over 500 participants from about 40 countries, including fishing skippers, fishing vessel owners, gear technologists, biologists, governmental fisheries administrators and manufacturers of fishing gear, auxiliary equipment (winches, echosounder and other electronic fishing aids,) and synthetic fibres.

The 111 papers presented to the Congress were reviewed and discussed in six technical sessions under the following headings: Materials; Rational Design and Construction of Fishing Gear; Strategy and Tactics of Fishing; Electrical Fishing.

Excursions were arranged to various fishing ports in Northern Germany, where the participants were able to observe different types of fishing gear, and have discussions with local fishermen and operators.

The great amount of technical information resulting from the Congress will be issued in book form under the title *Modern Fishing Gear of the World* to be prepared by FAO and to be published during 1958 by the publishers of *Fishing News*, J. Arthur Heighway Publications Ltd., Ludgate House, 110 Fleet Street, London, E.C. 4, England.

Symposium on Measurement of Primary Production in the Sea

The Symposium on the Measurement of Primary Production in the Sea, jointly

* For the role of FAO and IPFC in these Meetings see FAO ACTIVITIES: Meetings Attended and IPFC ACTIVITIES: Meetings Attended.

sponsored by the FAO, UNESCO and the International Council for the Exploration of the Sea (ICES) took place in Bergen, Norway on 27-29 September 1957. Different Committees were set up to deal with the standardization of different methods and recommendations for their use.

The Committee on Terms and Equivalents accepted standard definitions and conversion tables.

The Committee on Methods for Measurement of Primary Production described the difficulties still existing in interpreting the results of measurements and recommended further basic investigations of various questions. This Committee also agreed that the C^{14} techniques is, at the present moment, the most useful technique for measuring the production of organic matter in the sea and recommended its use.

The Committee on Chlorophyll described the relations between chlorophyll standing crop and photosynthesis and described further investigations that should be undertaken which will give a more accurate quantitative measure of the relations. Some recommendations were made on the use of different methods for determination of chlorophyll. It was agreed that the objective of the investigations would be to determine the methods to be used in special cases. Calibrations of instruments and standard samples of chlorophyll were recommended.

The Committee on Studies of Phytoplankton Populations stressed the urgency of a method for preserving seawater samples whereby naked flagellates and coccolithophorids retain their morphological characteristics. Such preservation is essential for enumeration of phytoplankton populations. It was also recommended that as soon as a satisfactory preservative for these minute forms is available, enumeration of phytoplankton populations should be extended to include the ultraplankton fraction so that data are provided for the total photosynthetic population.

The various technical papers presented at this symposium were recommended for publication. The Publication Committee stressed that the nature of the subject considered called for an expeditious printing of such a publication.

The 45th Statutory Meeting of ICES

This Meeting was held in Bergen from 30 September to 8 October 1957. Various decisions were taken on topics bearing on the activities of the IPFC and of some particular interest to its Members.

On the question of fish length measurement it was felt that the convenience of measuring fork length or total length varies with species. The research workers were however urged to record the methods used by them and pay particular attention to the accuracy of their measurements, specially with regard to the observed differences between the length of fish before and after death.

Particular attention was given to the effect of chafing gear, (i.e. pieces of net fixed to the lower and sometimes the upper part of the cod-end to protect the trawl from excessive wear) on the escape of small fish. It is believed that such gear reduces the selectivity of the trawl and hence affects the regulations for cod-end meshes in force in the North Atlantic.

The Council urged studies on the modes of chafing gear in order to develop substitutes which would avoid the risk of their interfering with escape.

Note: A fuller report on this Meeting will soon be distributed as an Occasional Paper of the Indo-Pacific Fisheries Council. —Ed.

IACOMS Second Session

The Second Session of the UNESCO International Advisory Committee on Marine Sciences (IACOMS) was held in Bangkok, 15, 16 and 18 November 1957. Nine members attended. FAO, IPFC and several other International Organisations and Institutions sent observers. Representatives of the Royal Thai Navy were also present as observers.

A Sub-Committee was appointed to consider the drafting of recommendations in connection with the organization of *Regional Marine Biological Reference Collections*. The term *Reference Collections* is being used to stress that the immediate need is not an extension of the exhibits of existing museums but to build up a systematic collection of all plant and animal species of the single country, preferably as a national reference collection of zoological, botanical and geological species. If such collections be established they will serve as material for taxonomic studies of the national flora and fauna and eventually the much needed handbooks for students of biology, ecology, etc.

The Committee also recommended to the notice of this Sub-Committee the proposal concerning *Regionnl Plankton Keys*. Subsequently, the Committee approved a recommendation requesting UNESCO to further explore the possibility of assisting member nations to establish such reference collections and agreed that the regional keys on the lines of the Plankton Keys published by the ICES and at Miami, by Dr. Walton Smith, would be of considerable assistance.

On the question of a *Regional Co-ordinator* for marine sicences activities in the Far East, the Committee proposed that such a person should be selected by UNESCO and his nomination should be referred to IACOMS for scrutiny.

The proposal for this Regional Co-ordinator originated in consideration of the lack of trained scientific personnel which poses a very serious problem in the immediate development of marine sciences in the Far East. Few, if any, of the institutions are able to cover the biological, physical and chemical aspects of oceanography. The diffuse distribution of qualified, mostly young scientists, could yield much more efficient work if the national efforts could be co-ordinated with the efforts of neighbouring countries. An experienced all round oceanologist should be available as an adviser and co-ordinator for all the countries in the region.

During discussions on the implementation of *UNESCO Plans in Marine Sciences for the Indo-Pacific Region*, the representatives of the Royal Thai Navy pointed out that the Hydrographic Research vessels of the Royal Thai Navy might on request be available for such work. It was also pointed out that the Indonesian Government might make available their research vessel "Samudera" as a training ship and that there was a possibility for the research vessel based at Madagascar being made available.

The Committee felt that the procedures necessary for UNESCO's proper consideration of the proposal for an *International Oceanographic Vessel* might involve the calling of a conference or formation of a working group of competent people to decide on the feasibility of the project and possible ways and means of implementing it. It was further considered that participants at the conference or the personnel of the working group should be properly

accredited representatives of governments and should be entitled to speak on behalf of their governments in relation to such a project.

A matter of direct concern to FAO and IPFC was the question of the provision of *Standard Type Plankton Nets* by UNESCO for use in the Indo-Pacific Region. The Committee recommended that UNESCO make a subvention of approximately US $ 500 to purchase 10 nets in response to the IPFC request. During discussions on this question, it was pointed out that there was no general acceptance of any one type of net as a standard, but it was thought that an effort should be made to set up primary plankton programme in the several countries of the region along the lines similar to the basic programmes previously adopted in the Northern Hemisphere.

It was proposed that the Third Session of the Committee should be held in Paris to commence during the second week of October and that arrangements should be made, if possible, for the Third Session to follow immediately a meeting of the Special Committee on Oceanography Research (SCOR).

Ninth Pacific Science Congress

The Ninth Pacific Science Congress of the Pacific Science Association was held in Bangkok, 18-30 November 1957. Over 500 delegates from various member countries participated. Several international organizations sent observers.

Some 20 papers were presented in the Fisheries Division. In addition, three papers on *nouc mam* and one on the use of aureomycin in the preservation of fish were presented in the Chemistry Division. One paper on fish flour for human consumption was also presented in the Nutrition Division.

The papers presented in the Oceanography Division numbered some 50.

Reviewing the progress in the utilization of the living aquatic resources in the Indo-Pacific Region, the Chairman of the Standing Committee on Fisheries made the following remarks on the role of the Indo-Pacific Fisheries Council:

"Progress in the development and utilization of the living aquatic resources of the Indo-Pacific area has been fostered by the Indo-Pacific Fisheries Council, a regional body of the Food and Agriculture Organization of the United Nations, with headquarters in Bangkok. The Council, now with 16 Member Governments, was established by the Baguio Agreement of 1948. Starting in 1949 seven sessions have been held at various centers in the region. These have greatly benefited the less-developed member countries by disseminating information on biological and technical advances in the field of fisheries, by advising on local problems in sea fisheries, pond culture, craftand gear, technology, socio-economics, and marketing, by recommending FAO technical assistance in establishing training centres and group country projects and, less tangibly, by providing an opportunity for establishing both professional acquaintance and personal friendship among the fishery workers of the region."

In a paper presented in the Symposium on New or Little Explored Aspects of Fisheries Research by Dr. H.S. Swingle, Alabama Polytechnic Institute, Agricultural Experiment Station, Auburn, Alabama, U.S.A., it was reported that statistical examination of populations in inland waters indicated that differences in total production of fish were not due to differences in available food, but were due primarily to certain interrelationships within the fish population themselves. The standing crop of fish varied inversely with the ratio between weight of forage fish and that of piscivorous fish. The multiple regression equation appeared to fit the data, with R=0.91.

$Y = 151.1 + 0.638\ A_T + 6.212\ F/C + 2.791\ S_F$, where

Y = estimated pounds per acre in the standing crop, A_T = percentage of total weight composed of fish harvestable size, F/C = weight of forage fish divided by weight of piscivorous fish, and S_F = percentage of total weight of forage fishes composed of small fish.

Factors causing fluctuations in A_T, S_F and F/C are known only in part. Change in F/C ratios appear to be cyclic in natural populations. Thus, it is shown that variations in abundance of fishes is in part regulated by their interrelationships with other species.

Discussing another presentation at the same Symposium it was pointed out that the use of meristic characters in the delimitation of stocks, may have limitations in the tropics, the environmental changes in the tropics not having wide ranges and the consequent changes in the meristic characters not being very well pronounced. The limited success in the use of scale rings for age determination of fish in the tropics was cited in support of the above contention.

During discussions on the Symposium on Techniques of Measuring Oceanic Productivity, it was suggested that although the C^{14} technique was a very useful tool, it had its limitations. Information were also presented on the usefulness of other new and promising techniques, such as the Chlorophyll-*a* technique for measuring oceanic productivity. The general feeling was however that no one particular technique would provide all the necessary answers and that there was need for the use, if possible simultaneously, of several techniques in the estimation of basic productivity.

In conncetion with the estimation of the zooplankton population it was suggested during the same Symposium that:

"In beginning any programme of estimating the varying quantity of zooplankton over an area, it is most important to be certain that the nets being used for collecting the samples are suitable for the purpose and being used in such a way that they give reliable results. Sampling should be repeated at interavls throughout the 24 hours at one place, and also at a number of positions close together, say ½ mile apart, and as near together in time as possible, in order to test how representative of the plankton in the neighbourhood a single net sample may be and also whether samples taken by day and by night give similar quantities. If such repeated hauls give widely different results the method is inadequate for sampling a wide area by a series of single hauls taken only at intervals."

Papers presented at the Symposium on Disposal of Radio-active Waste supported the theory of direct contamination pathway when the fish survives in water area where the fission products exist in the free state. The Sr^{90} fed directly to fish were eliminated about 95-98% within 2-4 days. Of the remaining amount about 98% was found in the structural tissues most of which is taken up by bones. Sr^{90} injected directly to the heart was taken up entirely by the plasma; the red cells carried practically no strontium. The amount of strontium in the blood decreased very rapidly, and levelled off at about 24 hours.

The maximum permissible concentration of Sr^{90} in isotopic dilution ratio is approximately 10^{-9} to total stable strontium in weight or in atom number. That for sea water is approximately 1,000 micro-micro-curie per litre.

On the business side, it was recommended to reorganize the Divisions of Fisheries and Oceanography into a Division of Marine

Sciences and another of Freshwater Sciences. The Division of Marine Sciences should include at least three disciplines: Oceanography, Marine Biology and Marine Fisheries. The Standing Committee for this Division should include sub-committees on these disciplines. The Division of Freshwater Sciences is to include the three disciplines of Limnology, Freshwater Biology and Freshwater Fisheries. The Standing Committee for this Division is also to include appropriate subcommittees. It was further recommended that efforts be made to arrange joint symposia by the Divisions of Marine Sciences and Freshwater Sciences.

The 10th Pacific Science Congress will be held in Honolulu, Hawaii, during the last week of August and the first week of September 1961.

Symposium on Oceanography and Sea Fisheries on the West African Coast

This Symposium was held at Luanda (Angola) from 21 to 27 November 1957, under the chairmanship of Professor F. Frade of Portugal.

The Symposium was in the nature of a scientific meeting, held under the aegis of the Scientific Council for Africa. The Secretariat of Meeting was the responsibility of the Joint Commission for Technical Co-operation in Africa South of the Sahara/ Scientific Council for Africa South of the Sahara (CCTA/CSA) Secretariat.

The Agenda included items on Physical Oceanography, Biological list (state, shortcomings in present knowledge) of marine animals and plants, State of general biological and ecological research, Biology of economically important species, Technology of fishing, Technology of fish handling and dreservation, Marketing of the catch and Enumeration of regional resources at the disposal of research workers in problems of fishing and concerted programme of work.

Over 40 technical contributions were presented at the Symposium.

UNO Conference on Law of Sea

An International Conference to deal with the final report of the United Nations International Law Commission on Law of the Sea will be held in Geneva next year. It will open on 24 February and is expected to sit for nine weeks.

The Conference has been convened by decision of the U.N. General Assembly. All members of U.N.O. have been invited to attend and 15 Inter-Governmental Bodies concerned with fisheries or other maritime matters have been invited to send observers.

The Commission's report covers the three fields of sea law: High Seas, Territorial Sea and Continental Shelf. Among the topics of particular interest to fisheries dealt with in the report are: the breadth of the territorial sea, the extent of the continental shelf, right of fishing and the conservation of the living resources of the sea.

Training Course in Marine Biology

UNESCO has initiated arrangements for holding a training course in "Marine Biology" at the Institute of Science in Bombay probably in March 1958. Approximately 25 participants from Ceylon, Burma, India, Nepal and Pakistan will be invited to the course. Two or three foreign specialists in the field are being invited to assist in running the course. Further details with reference to the syllabus etc. will be announced later. (*UNESCO Bulletin*, New Series No. **3**, September 1957).

Forthcoming Conferences, Meetings and Training Centres
January - December 1958

January	6-12	Indian Science Congress Association - 45th Meeting	Madras
„	22	Challenger Society	London
„	27-31	Economic Commission for Europe/World Health Organization/F.A.O. Meeting on Water Pollution in Europe	Geneva
February	24	United Nations Conference on the Law of the Sea	Geneva
April	9-14	International Association of Theoretical and Applied Limnology (IAL) - Symposium on Brackish Water	Venice
„ (2 weeks tentative)		Symposium on Marine Sciences in the Red Sea and Adjacent Waters followed by Refresher Course on Marine Sciences	Ghardaga, Egypt
April-May		Economic Commission for Asia and the Far East (ECAFE) - Study Tour on Water Resource Development	Undetermined
May	5-7	International Advisory Committee on Research in the Natural Sciences Programme of UNESCO	Paris
„	—	Economic Commission for Asia and the Far East (ECAFE) - Working Party on Community Development	Bangkok
June	—	XVI^{e} Congress des Peches et Industries Maritimes	Ostende and Brussels
„	9	International Commission for the North-west Atlantic Fisheries (ICNAF) - Annual Meeting	Halifax, Canada
„	30-July 4	Joint Meeting of the Association Technique Maritime et Aeronautique and the Institute of Naval Architects, London	Paris

July	7	International Trust for the Zoological Nomenclature - Colloquium on Zoological Nomenclature	London
„	16-23	16th International Congress of Zoology	London
„	–	International Union of Biological Sciences (IUBS) - 13th General Assembly	London
„	–	International Whaling Commission (IWC)	Dublin
August	11	6th Fisheries Conference of the North	Hindsgarl, Denmark
„	13-19	3rd International Seaweed Symposium	Galway, Ireland
„	10-16	International Congress on Radiation Biology	Burlington, Vermont
September	–	FAO Technical Meeting on Costs and Earnings of Fishing Enterprises	London
„	1-14	2nd International Conference of the Peaceful Uses of Atomic Energy	Geneva
„	9-10	American Fisheries Society - 88th Annual Meeting	Philadelphia
„	5-19	International Commission on Large Dams of the World Power Conference - 6th International Congress on Large Dams	New York
„	25-Oct. 5	International Council of Scientific Unions (ICSU) - 8th General Assembly	Washington
October	4-8	International Congress of Hydroclimatology	Lacco Ameno, Ischia
„	–	North Pacific Fisheries Commission	Tokyo
„	(tentative)	Indo-Pacific Fisheries Council (IPFC) - 8th Session	Ceylon
„	–	Permanent Commission of the International Fisheries Convention (1946)	London
„	–	International Council for the Exploration of the Sea	Copenhagen
October	(4 days)	United Nations Educational, Scientific and Cultural Organization (UNESCO) - Symposium on Salinity Problems	Teheran

October (3 days tentative)	UNESCO International Advisory Committee on Marine Sciences (IACOMS) - 3rd Session	Rome
October (5 days)	U.N./UNESCO Planning Meeting for the Study of Peaceful Utilization of Atomic Energy	U. K. (tentative)
November —	Society of American Naval Architects	New York
,, —	US National Research Council and US National Academy of Sciences - International Conference on Scientific Information	Washington
December 11-19	International Union for the Conservation of Nature and Natural Resources 6th General Assembly	Athens
Summer	International Congress on Microbiology	Stockholm

FAO TRAINING CENTRES

Dec. 16-Jan. 25, 1958	FAO/IPFC Training Centre on Fishery Co-operatives and Administration for the Indo-Pacific Region	Sydney and Adelaide
September - October (tentative)	FAO/ETAP/IPFC Seminar on Methodology and Techniques of *Rastrelliger* Research	Bangkok

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